THE

AMERICAN NATURALIST.

VOL. XVII. — *MARCH*, 1883. — No. 3.

ON THE EXTINCT DOGS OF NORTH AMERICA.

BY PROFESSOR E. D. COPE.

THE family of the Canidæ occupies in the order of the Carnivora, a position intermediate between the generalized forms, as the raccoons, and the highest or specialized forms, as the cats. While its sectorial or flesh teeth are well developed, the primitive tuberculars remain in the jaws behind them, frequently to the full number in the superior jaw, and in rarely less than the full number in the lower jaw. The sectorials themselves are of inferior type, for the superior generally lacks the anterior lobe, and the inferior has a large heel, which is frequently tubercular. The number of the toes, generally 5–4, is smaller than in the lower types, but not so much reduced as in the hyænas, where they are but four on all the feet. In spite of the intermediate position of the Canidæ in general structure, they display superiority to all of the other families in the character of the brain. There are four longitudinal convolutions of the cerebral hemispheres, while the other families have but three; though in some of them (civets, cats), the inferior (Sylvian) convolution is fissured at the ends.[1] This character of the dogs is in some degree parallel to that of man, whose great brain superiority is associated with general inferiority in the osseous and digestive systems.

The range of variation in the family Canidæ, is found in the number of the tubercular teeth, and of the tubercles of the sectorials, and in an occasional reduction in the number of the pre-

[1] For the characters of the families of Carnivora, see Proceed. Amer. Philos. Soc., 1882, p. 471.

molars.[1] Thus in Megalotis the true molars number $\frac{3}{4}$, and in Icticyon, at the other end of the series, $\frac{2}{2}$. The genus which adds to this reduction a further diminution in the number of premolars, Dysodus,[2] is only known in a domesticated condition.

The Canidæ probably first appeared in the Upper Eocene epoch. Cuvier described a *Canis parisiensis* from the Gypsum of Montmartre, but it is not as yet known whether it belongs to the restricted genus Canis or not. From the Phosphorites of Central France come the *Canis filholi* Mun. Chal., and *Brachycyon gaudryi* Filhol. The phosphatic deposit in which these species occur, contains fossils of both Eocene and Miocene age, so that the position of these Canidæ is yet uncertain. In North America no undoubted species of Canidæ has been found in beds older than Oligocene or oldest Miocene; that is below the White River formation. They are most abundant in the John Day epoch, or Middle Miocene, and are not rare in the Upper Miocene, or Loup Fork epoch. Species accompany the Pliocene fauna everywhere.

I give the following analysis of the extinct genera found in North America:

I. Molar formula $\frac{4}{4}\ \frac{3}{3}$.

Humerus with epitrochlear foramen.....*Amphicyon.*

II. Molar formula $\frac{4}{4}\ \frac{3}{3}$.

a. No anterior lobe of superior sectorial.

β. Humerus with epitrochlear foramen.

Inferior sectorial with heel trenchant.....*Temnocyon.*

Inferior sectorial with heel basin-shaped.....*Galecynus.*

ββ. Humerus without epitrochlear foramen.

Inferior sectorial with heel basin-shaped.....*Canis.*

aa. An anterior lobe of superior sectorial.

Heel of lower sectorial basin-shaped; no epitrochlear foramen .....*Ælurodon.*

III. Molar formula $\frac{3}{3}\ \frac{2}{2}$.

Heel of inferior sectorial trenchant; premolars lobed posteriorly.....*Enhydrocyon.*

Heel of inferior sectorial basin-shaped; superior molars unknown .....*Tomarctus.*

IV. Molar formula $\frac{4}{4}\ \frac{1}{2}$.

Heel of inferior sectorial basin-shaped; internal cusp present.....*Oligobunis.*

V. Molar formula $\frac{3}{3}\ \frac{1}{2}$.

Premolars lobed; first inferior two-rooted.....*Hyænocyon.*

To these genera I refer twenty-five species of the American Miocenes.

[1] For the genera of Canidæ, see Proceeds. Acad. Nat. Sci. Philada., July, 1879.

[2] See on this genus AMERICAN NATURALIST, 1881, p. 233, and July, 1879.

AMPHICYON Lartet.

Much is yet to be desired in the elucidation of the characters of this genus, especially of the American forms, which are less abundant and of smaller size than those of Europe. The typical species, *Amphicyon major* Blv., was the largest, equaling a bear in size. It is derived from the Miocene of Sansan, France, and a smaller form of it is found, according to Pomel, at San Gerand-le-Puy. Other species are derived from the latter locality, and all are typical of the Miocene formation in Europe. In the "Miopliocene" of India, a single species has been discovered, the *A. palæindicus* of Lydekker. The species occur in the Lower and Middle Miocene of North America, the largest of which about equals the wolf in size. On account of the large development of the inferior tubercular teeth, I have suspected that the *Canis ursinus* Cope, from the Loup Fork group of New Mexico, would prove to be an Amphicyon. If so, it is the only representative of this genus in our Upper Miocene.

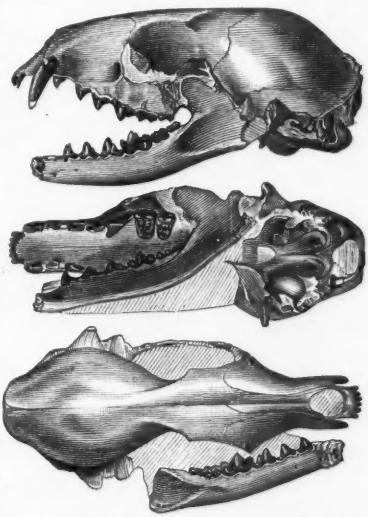


FIG. 1.—*Amphicyon cuspigerus* Cope, with the last superior molar lost; one-half natural size. Three views of skull. From the John Day beds of Oregon. Original.

The three American species differ as follows: The *A. cuspigerus*[1] is small, not exceeding the kit-fox in dimensions. The *A. hartshornianus* is about the size of the coyote, and has rather small tubercular molars, especially of the lower series. The *A. vetus* Leidy, is a little larger, but has the tubercular molars disproportionately larger than those of the *A. hartshornianus*.

TEMNOCYON Cope.

The characters on which I rely at present for the discrimination of this genus from Canis are two. The first is the presence of a cutting edge on the superior face of the heel of the inferior sec-

[1] *Amphicyon entoptychi* is the same.

torial, in place of a double row of tubercles surrounding a basin. When well developed these characters present a broad contrast, but indications of transitional forms are not wanting. Thus, in some extinct Canes the internal crest of the heel is less elevated than the external, which is the homologue of the single crest of

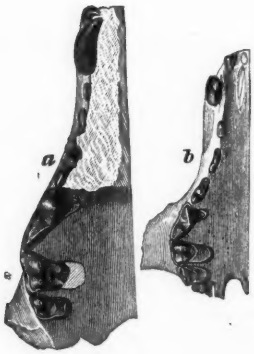


Fig. 2.

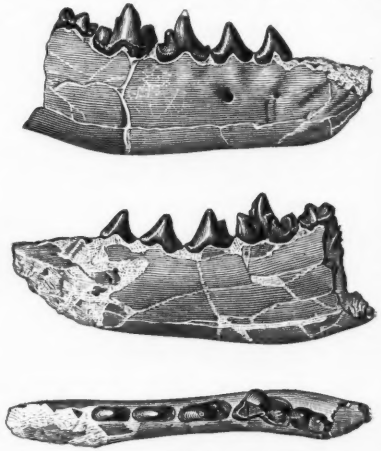


Fig. 3.

FIG. 2.—*a*, *Temnocyon altigenis* Cope, superior teeth of right side. From the John Day epoch of Oregon; *b*. *Amphicyon hartshornianus* Cope, superior teeth of right side; from White River epoch of Colorado. Both figures one-half natural size. Original.

FIG. 3.—*Temnocyon altigenis* Cope, part of right mandibular ramus, one-half natural size; viewed from without, within, and above. Original. From Report U. S. Geol. Survey Terrs., Vol. IV.

Temnocyon, and in some specimens of *Temnocyon coryphæus* there is a cingulum on the inner side of the median keel, which represents the internal crest of Canis. Secondly, the epitrochlear foramen of the humerus, a character common to all of our Lower Miocene Canidæ yet known.

The keel of the sectorial, which defines this genus, is simply a repetition on that tooth of the keel which belongs to the posterior premolar teeth of many Carnivora. I find resemblances in such Eocene forms as Mesonyx and Palæonyctis. Among recent Canidæ it is apparently known only in the genus Icticyon, and is very rare in other groups. The *Cynodictis crassirostris* Filhol, from the French Phosphorites, strongly resembles the species of Temnocyon in generic characters, and the *Amphicyon incertus*, also French, may turn out to belong to this genus.

Three American species certainly belong to Temnocyon. These differ in size, proportions and the forms of the superior tubercular molars. The largest, and type of the genus, the *T. altigenis* (Fig. 3), is as large as a wolf. *T. wallovianus* Cope, has a shorter and wider head. *T. coryphæus* (Fig. 4) is as large as the coyote, and was very abundant during the John Day epoch in Oregon. *T. josephi* Cope, provisionally referred to this genus, is still smaller, and has a narrower muzzle and wider face. All the species differ from the true dogs in their shorter muzzle and longer and nar-

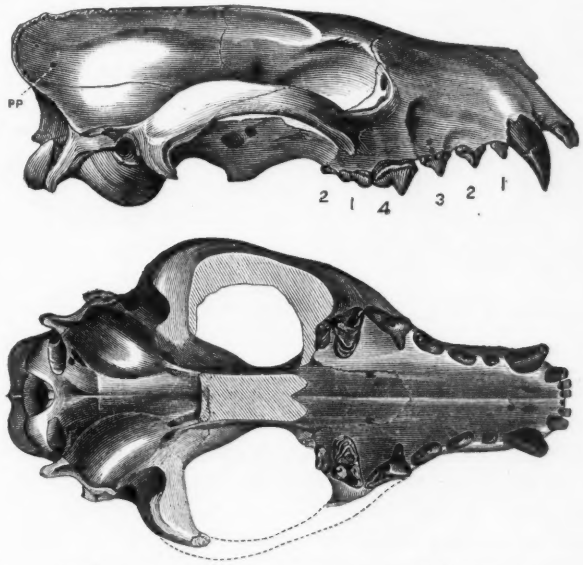


FIG. 4.—*Temnocyon coryphæus* Cope, more than one-half natural size. From John Day epoch, Oregon. Original. From Report U. S. Geol. Survey Terrs., F. V. Hayden, Vol. IV. The numbers indicate the premolars and molars. No. 4 is the sectorial.

rower brain-case, in these points resembling the civets. They come from the John Day epoch, and probably also the White River beds of Nebraska.

GALECYNUS Owen.

This genus, which is abundantly represented by species and individuals, existed during the Upper Eocene (the Phosphorites), and Miocene epochs in Europe, and also during the White River, or Oligocene, in North America. As the structure of the feet of

the numerous species from these epochs is not yet known, and, therefore some doubt as to their correct generic reference may still exist, I only regard the genus as a certain inhabitant of North America during the John Day, or Middle Miocene, epoch. This is indicated by the *Galecynus geismarianus*, where the number of the toes on the posterior foot has been ascertained (Fig. 6).

All the species of the genus from Eocene and Lower Miocene beds, as well as most of those of the Loup Fork epoch, are characterized by the relatively small size of their sectorial teeth.[1] In this they resemble the Amphicyons, Temnocyons and other forms of Canidæ of the same period, and differ from such Canes as *C. ursinus* and *C. haydeni*, which display the enlarged sectorial teeth of the existing species of the genus. Of course there is every gradation in this respect between the two types. In the older species the internal tubercle of the inferior sectorial tooth is more largely developed than in the latter ones, thus approaching some of the species of Viverridæ, where it is still more largely developed. As in other characters, there are gradations in this also, so that neither in it nor in the relative size of the sectorials do I find ground for the separation of the species in question from the genus Canis, as has been proposed in the case of some of the species in Europe. Through the kindness of M. Filhol, I possess jaws of a number of the species found by himself and others in the Phosphorites of Central France, including the *Canis velaunus*, the type of the genus Cynodon of Aymard. These agree very nearly with the species of dogs from the American Miocene beds as to generic characters. Professor Owen proposed to distinguish the genus Galecynus on account of the greater length of the pollex as compared with that found in the existing species of Canis. This character appears to me to be of an unsatisfactory nature, owing to the fact

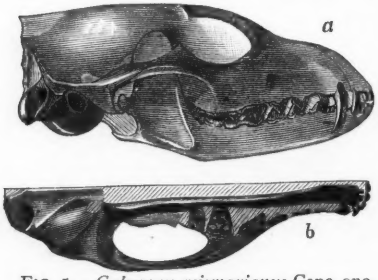


FIG. 5.—*Galecynus geismarianus* Cope, one-half nat. size, skull from side and below. From John Day beds, Oregon. Original.

[1] See Bulletin U. S. Geol. Survey of the Terrs., F. V. Hayden, Vol. VI, 1881, p. 180.

that gradations in the length of a digit are difficult to express with precision in other than a specific sense; and the gradations may certainly be expected to occur.

I find in the *G. geismarianus* a character which separates the genus from Canis, viz., the presence of the epitrochlear foramen of the humerus. In this point it agrees with Amphicyon and Temnocyon. I arrange cotemporary and generally similar species under the same generic head, as the most reasonable course in the absence of direct evidence.

I know four species of Galecynus from American localities. These are, in the order of size, beginning with the largest. *G.*

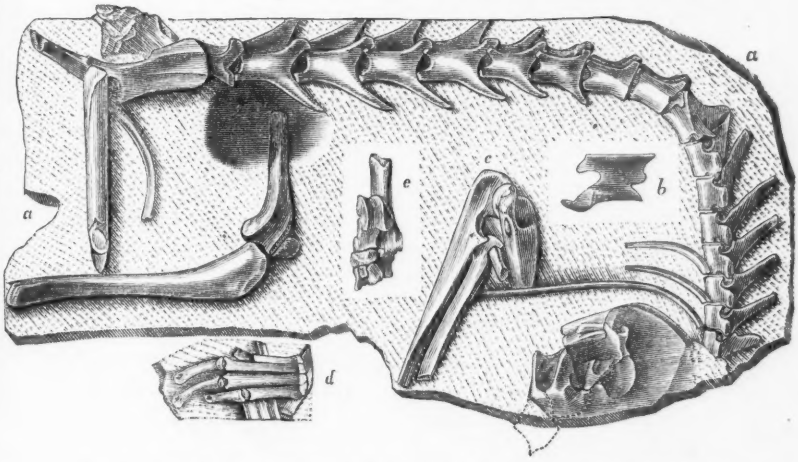


FIG. 6.—Part of skeleton of one individual of *Galecynus geismarianus*, one-half nat. size; from the John Day bed of Oregon; *a*, vertebral column with pelvis; *b*, axis vertebra; *c*, elbow, showing epitrochlear foramen; *d*, metatarsus and phalanges; *e*, tarsus, showing grooved astragalus. Original.

geismarianus Cope (Figs. 5–6), *G. latidens* Cope, *G. gregarius* Cope, and *G. lemur* Cope (Fig. 7). Three of these are confined to the John Day Miocene, while the *G. gregarius* is abundant in the White River formation of Colorado and Dakota. The *G. geismarianus* (Figs. 5–6), is a little smaller than the gray fox (*Vulpes virginianus*), and had a more civet-like form. That is, the body was relatively longer and the limbs shorter. The *G. lemur* (Fig. 7) is remarkable for its very large orbits and otic bullæ. These indicate large eyes and large ears, and render it probable that the animal was nocturnal in its habits. These, with its

short, sharp nose, must have given it a physiognomy something like that of the existing fennec of Nubia.

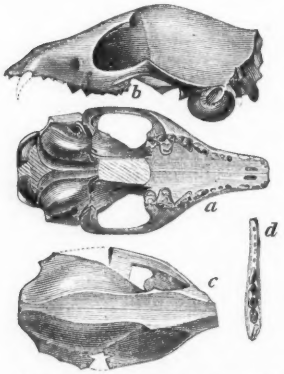


FIG. 7.—*Galecynus lemur* Cope, skull and mandibular ramus (Fig. *d*), one-half natural size. From the John Day epoch of Oregon. Original.

Filhol has described seventeen species of this genus from the Phosphorites of France, and has given several generic names to groups which do not seem to be distinct from it.

CANIS Linn.

The oldest species of true dog known to me from American formations is the *C. brachypus* Cope, from the Ticholeptus epoch of Wyoming Territory. It is about the size of the coyote, but has the small sectorial teeth of all primitive Canidæ. Its feet are smaller than those of the coyote, and the sagittal crest of the skull more elevated.

True dogs are more numerous in the Loup Fork beds. Leidy describes *C. vafer* and *C. temerarius*, the first as large as the kit-fox; and the second between the red fox and the coyote in dimensions, both with small sectorials. He also describes a huge species, with large sectorials, under the name *C. haydeni*, which may be an Ælurodon, for the superior teeth are not known. These species are from Nebraska. Another large species is the *C. ursinus* Cope, from New Mexico. It has not only large sectorials but large inferior tuberculars below, which arouses the suspicion that when the superior dentition is obtained, it will prove to be an Amphicyon. The form of the mandible is very peculiar.

FIG. 8.—*a*, astragalus of *Canis brachypus; b*, right astragalus and calcaneum of *Ælurodon sævus; c*, three left metatarsals of do.; all three-eighths nat.size. Original.

Canis lupus (the wolf) and *C. latrans* (the coyote) are found in the Pliocene or Equus beds. From these species many of the domesticated dogs have been derived.

TOMARCTUS Cope.

One species known from the Loup Fork beds

of Colorado. It is uncertain whether this genus has two or three premolars. Should it have three it must be compared with the Brachycyon of Filhol. But the inferior sectorial tooth of that genus is as yet unknown. In Tomarctus it is like that of Canis and Ælurodon. The *T. brevirostris* has teeth as large as those of a coyote, but has the lower jaw shorter and more slender.

ÆLURODON Leidy.

Dr. Leidy described an *Ælurodon ferox*, whose affinities he did not determine, but which he thought to combine characters of

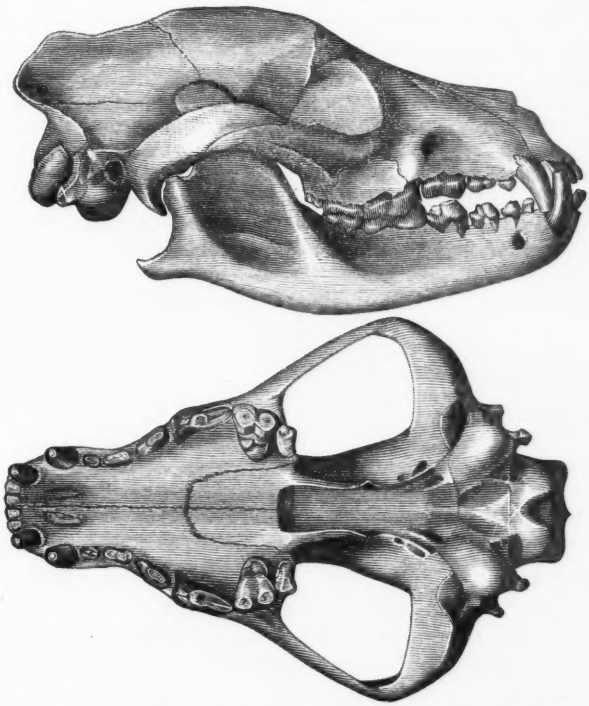


FIG. 9.—*Ælurodon sævus* Leidy, skull three-eighths nat. size. From the Loup Fork beds of Nebraska. Original.

dogs and cats. I have proven[1] by material in my possession, that the *Ælurodon ferox* and the *Canis sævus* Leidy, are the same species. The genus Ælurodon must be referred to the Canidæ, and

[1] Bulletin U. S. Geolog. Survey Terrs., VI, 1881, p. 387.

distinguished from Canis proper, only by the presence of an anterior cutting lobe of the superior sectorial tooth, the character on which Dr. Leidy originally proposed it. There are three species of the genus known to me, the *Æ. sævus*, *Æ. wheelerianus* (*Canis* Cope) and a smaller one which I called *Æ. hyænoides*. The character of the superior sectorial tooth above mentioned is as much like that of Hyæna as Felis, and the entire sectorial tooth in the *Æ. hyænoides* is much like that of the former genus. In all three species the premolars are very robust, as though to aid the sectorials in crushing bones, as they do in the hyænas. The second metacarpal bone has on its inner surface a rough area of insertion, such as is present in the dogs and absent in the hyænas, and which may indicate five digits in the anterior foot, the general character of the Canidæ, and not as in the Hyænidæ. I nevertheless suspect that this genus is the ancestor of the Hyænidæ, through the intermediate forms, Ictitherium and Hyænictis. According to Gaudry, Ictitherium has the same number of digits as the Canidæ, and the same dental characters as Ælurodon, excepting in the absence of the last inferior molar. He shows a successive reduction in the dimensions of the superior true molars in the three species of Ictitherium, followed by the loss of the second in Hyænictis. I have followed Gaudry in placing the former genus in the series of Epimycterous Carnivora near the Viverridæ; but that division was largely derived from the Hypomycterous division, to which the Canidæ belong.

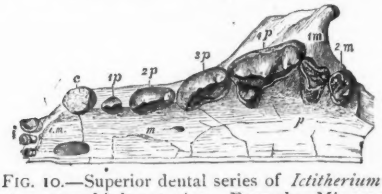


FIG. 10.—Superior dental series of *Ictitherium robustum*, two-thirds nat. size. From the Miocene of Pikermi, Greece. After Gaudry.

The *Ælurodon wheelerianus* Cope (Fig. 11), was abundant in Nebraska, though originally discovered in New Mexico in the Loup Fork beds. It is a more robust animal than *Æ. sævus*, and differs in various details. The skull was of about the same size, viz., rather shorter, but stouter than that of the *Canis lupus*. The *Æ. sævus* was equally abundant in Nebraska (Fig. 9). With the *Æ. wheelerianus* it probably performed the function of a scavenger, devouring the remains of the antelopes and small camels of the Loup Fork epoch. The *Æ. hyænoides* is a smaller species with some peculiarities of its own, from Southern Nebraska.

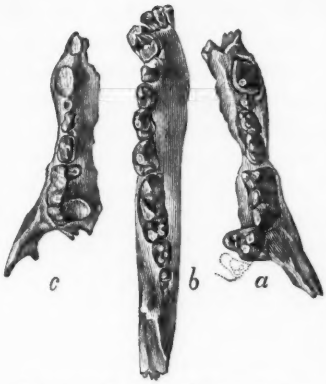


FIG. 11.—Jaws of Ælurodons, three-eighths natural size. *a–b*, *Æ. wheeleri-anus* Cope, upper and lower dental series. *c*, *Æ. hyænoides* Cope, superior series lacking the last true molar. All three-eighths nat. size. From Loup Fork beds of Southern Nebraska. Original.

ENHYDROCYON Cope.

This genus is represented by a single rather large species, the *E. stenocephalus* Cope. The general form of the skull is that of Temnocyon, but the shortening of the muzzle is carried so far as to leave space for only three superior premolars. These have posterior lobes as in Canis, and the first is two-rooted. The muzzle is broad and flat above, and the brain-case is long and narrow. The general form of the skull would be that of an otter, but for the presence of a high sagittal crest (Fig. 12). Whether or not it is the ancestral source of the otters, cannot yet be ascertained. Its appearance suggests an aquatic habit. Were the muzzle of similar proportions, the skull would be as large as that of a wolf.

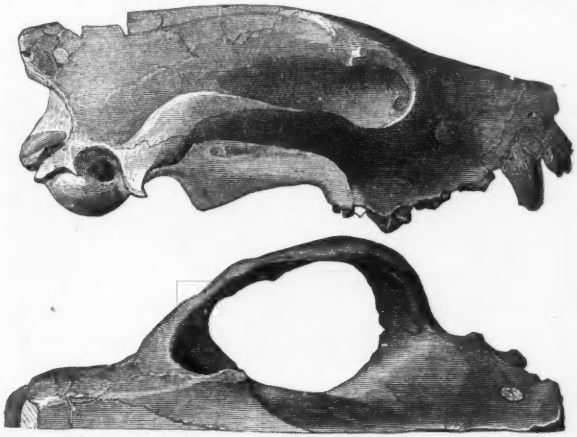


FIG. 12.—*Enhydrocyon stenocephalus*, skull, two views, one-half natural size. From the John Day beds of Oregon. Original.

HYÆNOCYON Cope.

The dental series is still more reduced in this genus than in the

last, for with three premolars above and below, there is but one true molar above. The premolars are like those of Enhydrocyon. The flesh teeth are much more developed, equaling those of the most specialized Canidæ. The family location of this genus is indeed not assured, but the superior true molar is a good deal like that of the Canidæ, so far as known. The type is *H. sectorius* Cope (Fig. 13), a species the size of a coyote, but more robust. A second species, *H. basilatus* (Fig. 13) is larger, and is only known from lower jaws. These species, are from the John Day beds of Oregon, and are the most formidable Canidæ of that period, though they do not appear to have been abundant.

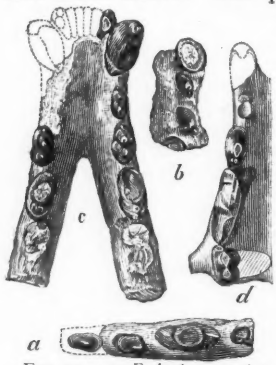


FIG. 13.—*a, Enhydrocyon stenocephalus*, part of mandible from above; *b*, do., part of maxillary from below; *c, Hyænocyon basilatus*, part of mandible from above; *d, Hyænocyon sectorius*, maxillary bone from below. All three-eighths nat. size, and from the John Day beds, Oregon. Original.

OLIGOBUNIS Cope.

This genus has the dental formula of the existing neotropical genus Icticyon, but differs from it in

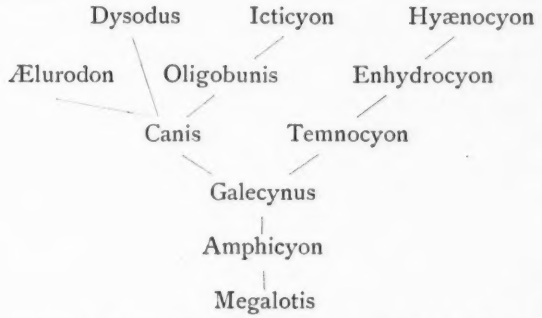
FIG. 14.—*Oligobunis crassivultus* Cope, one-half natural size. *a*, right maxillary bone with teeth from below; *b*, right mandibular ramus from above. From the John Day river of Oregon. Original.

the form of the inferior sectorial tooth. In Oligobunis it has the primitive form seen in most of the Miocene species, while according to Flower, in Icticyon there is no internal cusp, and

there is a cutting heel. The number of true molars, $\frac{1}{2}$, is the smallest in the family. A single species is known, the *O. crassivultus* Cope, from the John Day bed of Oregon. The skull is about the size of that of the wolverene (*Gulo luscus*), and is of robust form. The canine teeth are powerfully developed, and indicate an animal of strong predaceous instincts.

General Observations.

The succession of these genera, as indicated by their structure, is as follows:



This order is not entirely that of succession in time. Thus Megalotis, which represents the primitive type of all Canidæ, is only known as living, and the *Megalotis zerda* is African. We anticipate its discovery in a fossil state. Amphicyon and Galecynus are the oldest known Canidæ, as they characterize the lowest Miocene, and probably the Upper Eocene epochs, Canis appears next in time in Europe, probably in the Middle Miocene. In America the genera of the John Day Middle Miocene precede Canis. I refer to Temnocyon, Enhydrocyon, Hyænocyon and Oligobunis, which were contemporaries. Ælurodon appeared later than Canis in the Upper Miocene and Loup Fork, and Dysodus and Icticyon with various other genera not here enumerated, are recent. Canis is the prevalent genus in the present period, as Galecynus was during the Miocenes. That the last named genus, with its numerous species, has given origin to the existing species of Canis, as suggested by Filhol, is altogether probable.

As already mentioned, the successional change in the Canidæ has been exhibited in the reduction of the numbers of the tubercular teeth. To this may be added a successive increase in the size of the sectorials and canines. In these points the Canidæ

epitomize the history of the evolution of the dentition of the order of Carnivora. This I stated as follows, at a meeting of the Philadelphia Academy of Feb. 16, 1875:[1] "The important change [in the Carnivora] which is clearly indicated, is the progressive extinction of the genera with numerous sectorial teeth, accompanying the increasing specialization of those which remain. In other words the numerous types of digitigrade Carnivora which have survived, are those developing one sectorial tooth (whose earliest representative is Didymictis). The increased perfection of the sectorial has been associated with a reduction in the number of the other molars, first posterior, then anterior to it, which reduction has been accompanied by an increased relative size of the sectorial." These views were extended in a paper on "The Origin of the Specialized Teeth of the Carnivora," in the AMERICAN NATURALIST for March, 1879. In a paper published in the Proceedings of the Zoölogical Society of London, August, 1880, Professor Huxley comes to the same conclusion that I have stated in the above papers, in apparent ignorance of their prior publication.

As regards the origin of the Canidæ, it is doubtless to be found among the forms of the Creodonta.[2] The Creodonta are flesh-eaters of various degrees of power, without scapholunar bone; with well defined canine teeth; with a low type of brain, and generally imperfect ankle-joint. They stand in nearest relation to the Insectivora, but have points of resemblance to the Marsupialia. I originally included them as a sub-division of the Insectivora,[3] but subsequently placed them with the Insectivora and several other sub-orders in a comprehensive order, which I termed the Bunotheria.[4] This view of the origin of the Carnivora was subsequently reaffirmed by Huxley in his paper of 1880, above cited. He reproduces all my evidence, and in some cases almost my language, but is evidently unacquainted with the previously existing literature.

I have indicated the Miacidæ as the probable parental stock of the Canidæ among the Creodonta.[5] They are the only members

[1] Proceedings, p. 22.

[2] See Report U. S. Geol. Survey W. of 100th mer. G. M. Wheeler, 1877, II, p. 282.

[3] Proceedings Academy Philada., 1875, Nov., p. 447.

[4] See Report Capt. Wheeler, 1877, IV, p. 85.

[5] On the genera of the Creodonta, Proceed. Amer. Philos. Soc., 1880, p. 81.

of the sub-order which exhibit the true sectorial tooth of the upper series, as it exists in the Carnivora, and the genus Didymictis has the dental formula of Canis above. Miacis has the formula of Canis below, but that of the superior series is unknown. It would not be surprising if it should turn out to be that of Amphicyon. These animals are abundant in the Middle and Lower Eocenes of North America.

——:o:——

"THE PLAINS" OF MICHIGAN.

BY PROFESSOR V. M. SPALDING.

IN the northern central portion of the lower peninsula of Michigan there extend through several counties large tracts designated on some of the maps as "barrens," but uniformly spoken of as "the plains" by people living upon them or in their vicinity. One of these tracts, perhaps the most extensive, lies along the line of the Mackinaw division of the Michigan Central railroad and occupies a large portion of Crawford county, extending into the adjacent counties on the east side and south, and including an area of over a thousand square miles. A similar, though somewhat less extensive, region of barrens or plains is intersected by the Flint and Pere Marquette railroad, having its center in Lake county, extending southward into Newaygo and northward as far as the Manistee river. Similar plains, of greater or less extent, are to be found in this part of the State and in the northern peninsula, but the two tracts already mentioned may be taken as fair repretatives.

These plains lie in what is known as the "pine belt" of Michigan, and include the poorest portions of this extensive region. Their soil is a light sand, so fine that it penetrates one's shoes as he walks over it, and when a handful is closely examined it is seen to consist almost wholly of fine grains of silica, "good to make glass of," as is remarked by those of the inhabitants who do not believe in its agricultural capabilities. Nevertheless, these plains are by no means a desert. They support quite a variety of vegetable life, and one experiences no feeling of loneliness as he travels over them. On the contrary, wherever they have escaped the destructive action of fire, the smooth, gently undulating ground, with its groves of scrub pine, through which the eye has an extended range in every direction, produces a pleasing impres-

sion and we are constantly half-inclined to the delusion that we are walking through an artificial grove, and that just over the knoll or beyond the hollow the buildings of the proprietor will be seen. This is, however, a most unsubstantial feeling and cannot be trusted in the least, for one may wander about for miles without coming upon any trace of human life except the wagon track he is following and occasional blazes on the trees that indicate the path followed by hunters and land-lookers who have gone before him. Indeed there is sometimes real danger of losing one's way, unless he is something of a woodsman, and accounts are not wanting of those who have been lost and have perished from fatigue and hunger on these barrens.

The thing that attracts the attention at the outset and continues to do so, until its constant repetition ceases to produce the impression of anything unusual, is the fact that a large portion of this region has been swept over time and again by fire. Here the fire has passed over within a year, and remnants of the blackened stems of young trees and shrubs that had sprung up after some earlier fire are still standing and the ground itself is bare and blackened. There the conflagration took place a few years ago, and the ground is thickly covered with a new growth several feet in height, the path of the fire being indicated by the tall, charred trunks of larger trees that overtop as complete a picture of desolation as can well be imagined. In the midst of this ruined territory, and often extending for considerable distances, are groves and even good-sized forests, that in some way have escaped destruction and still remain, waiting the equally certain fate of the lumberman's axe or another fire.

The trees that cover a large portion of the plains are scrub pines (*Pinus banksiana*), universally called "Jack pine" by the people, and designated as "Spruce pine" in the notes of Government surveyors. It is not, when it attains its full development, a "straggling shrub or low tree," but often rises to the height of fifty or sixty feet and is really a shapely tree, fit for telegraph poles and like uses if only its wood were less subject to decay. Made into fences it lasts only a few years, and by common consent it is left unused, except for fuel, enjoying the distinction of being considered the most miserable production of this miserable soil. Its great abundance constantly suggests the query as to what it is good for. If the manufacturers of wood pulp can succeed in util-

izing it they will find an almost unlimited supply on the barrens of northern Michigan.

Among the scrub pines, and still more in the openings where they are less numerous, oak grubs are distributed far and wide, sometimes rather thinly, as is the case on the lightest sand, while in other places, and generally on the western barrens of the State, they stand more closely together and their rapidly growing sprouts are fast becoming a new forest. There is a story among the Indians living in Lake county that the plains were formerly covered with a forest of oak and pine (presumably white and red pine), but not far from the beginning of the present century a great wind swept over them, prostrating the oaks and leaving the pines, after which a fire destroyed them both, and Jack pines grew up in their place. Whatever significance may or may not be attached to this account, it is certain that the young oaks that are now growing so rapidly on the plains have come from stumps of old trees and not from acorns. The stumps are hardly ever to be seen at the surface, but upon removing a little of the earth or mold from the midst of the group of young trees they are found, often in a fair state of preservation, and of such dimensions as to show that a fair-sized oak tree formerly stood on the spot. The prevailing species are the white and black oaks (*Quercus alba* and *Q. tinctoria*), though in certain localities the red oak (*Q. rubra*) is of common occurrence. Many of these are six to eight or even ten feet high, and, over wide areas, are thick enough together to constitute a perfect forest. In a few years these oaks, if protected from the ravages of fire and the browsing of domestic animals, would furnish a considerable amount of valuable timber. Even now such as have escaped these accidents and have grown to a suitable size are eagerly sought after by mechanics for parts of wagons and like uses, and lumbermen go long distances to get them for pieces of timber. A proper oversight of these young forests, that are already planted and far on their way to useful dimensions, would well repay the State or other owners of the land, although the oak trees that largely compose them cannot be expected to attain very large dimensions on lands of such inferior quality.

Next to the scrub pine and oaks, two kinds of poplar are the most common trees on the plains. They are the quaking aspen (*Populus tremuloides*), and the large-toothed aspen (*P. grandidentata*). In low places they cover the ground, and often on higher

land are even more abundant than the pines and oaks. Like them, too, they are making an exceedingly rapid growth, and in a very few years after a fire they have covered the ground with a new forest and are stretching upwards with marvelous haste, as if to cover in the shortest possible time the blackened deformity of the charred remains about them. Like the scrub pine they are waiting for the demands of some great industry to turn their immense growth of material to profitable account.

Besides the scrub pines, oaks and poplars, which constitute the most prominent and almost universal arboreal feature of the plains, various other trees and shrubs are scattered here and there. The wild cherry, both black and red, the choke-cherry and sand-cherry are all here, and the prairie willow (*Salix humilis*), is always to be found, though seldom very thickly distributed. Sweet-fern (*Comptonia asplenifolia*), and brakes (*Pteris aquilina*), grow in great abundance over the entire region, and with them, spread like a carpet over the sands, are the bear-berry and winter-green and trailing arbutus, all uniting, by the extension of roots and decay of stems and leaves, in the grand effort made by nature to reclaim the soil. Then, as if to relieve the monotony of this constant and rather somber background, there are thrown in patches of bright bluebells, the wild orange-red lily, here and there a hawk-weed or Solidago, or the bright umbels of a stray pleurisy-root, and, once in a while, one of the rarer northern plants, such as the three-toothed cinquefoil, serving to keep the traveler, if he happens to be a botanist, on a constant and expectant lookout for something new.

The species that have been mentioned by no means complete the list, but they serve to show what are the constant and characteristic features of the vegetation of the plains. Although very many more species will be found in a "flora" of these regions, one is constantly impressed with the uniformity and lack of variety which characterize their vegetable productions. With all of Nature's most persistent efforts to clothe the barest places of earth with a living mantle, it has been found, apparently, that only certain kinds of plants can be made to do duty on these barren spots, and, accordingly, those have been chosen that flourish in places the most uncongenial and hopeless.

Two most valuable species have been reserved for special mention, partly because they do not strictly belong to the plains,

at least in the narrower sense of the term. Over considerable portions of their surface it is impossible to find a single white or even "Norway" pine, but wherever the soil changes from the light sand already described to one containing a slight admixture of gravel or loam, and often even when no such change is distinctly obvious, the scrub pine is replaced by the red or "Norway" pine (*Pinus resinosa*). With this, or scattered through hardwood timber, and indicating a soil still somewhat further improved in quality, is the white pine (*Pinus strobus*). Both of these are distributed in tracts of greater or less extent through the plains, but attain a larger development on the better lands beyond them. It is these two species that have given their great value to the pine lands of Michigan, and for the last quarter of a century have furnished such immense quantities of lumber to the markets of the world. Their rapid destruction, with no attempt on the part of any one to replace them or to provide for a future supply, is looked upon with alarm by those who take an intelligent interest in the financial prosperity of the State. It has become a question of immediate and pressing importance, what can be done with these large areas that have already been stripped of their most valuable timber and, abandoned by their owners, are now run over by fires from year to year that exhaust the soil of what little fertility it may have had and leave the whole region a blackened scene of desolation.

The "pine belt," within which these lands lie, is bounded nearly enough for practical purposes by the 43d parallel of latitude on the south and the 45th on the north. As a whole, it is by no means the worthless region that it is still quite generally regarded, but contains extensive areas of hardwood lands, valuable for farming purposes, that are passing into the hands of settlers whose crops of wheat and oats and fruits of various kinds rival those of the older and more favored portions of the State. The future of these better parts of the pine region is already determined. The well-fenced farms, with good buildings and beautiful fields of grain, that are already found in the very midst of a region that a few years ago was reported to be "one great swamp," are a sufficient guaranty that these lands will be permanently and profitably devoted to agricultural purposes. Whether or not this may be less profitable to the State at large than the continued production of timber will not affect the case.

When there are lands of such value for farming they will be purchased and held for this purpose and the interests of the State will in the end have to be adapted to those of the individual.

But however excellent certain portions of the pine belt may be for grain and fruit raising, the fact remains that there are some hundreds of thousands of acres, including the plains already described and considerable areas beyond them, that, so far as present evidence goes, are utterly worthless for agricultural purposes. It is with the future of these sandy plains and deserted and burned pine "slashings" that we are now concerned. A scanty population has already taken possession of certain portions of this territory, and here and there attempts have been made at its cultivation. The settlers have turned over, or dragged over, the light sand and have put in here a piece of rye and there a few potatoes and have attempted in other places to get a field covered with clover or timothy. The results attained are by no means satisfactory. Rye, their best crop, is thin and light. Potatoes are small and few in a hill. A really good piece of wheat or oats was not seen in a journey of forty miles through the plains, and, with perhaps one or two exceptions, the same is true of grass and clover. Whatever may develop, in the future, it is perfectly safe to say that as yet the agricultural capabilities of these plains are not apparent.

In many instances the lands that have been sold to individuals or to corporations, after having been stripped of their pine, revert to the State through failure on the part of their owners to keep up the taxes, this failure manifestly resulting from a belief on their part that after the timber is removed the land is not worth the taxes. This result has hitherto been considered unfortunate, from the fact that the State government is obliged to assume the responsibility and expense of ownership, and the law has recently been changed so as to more fully protect individual purchasers of tax titles, largely for the purpose of relieving the State of this burden. In addition to this the attention of the public is called to these and other lands in the possession of the State by a pamphlet issued by the Commissioner of Immigration (a work, by the way, full of valuable information), and the three principal railroad companies whose lines intersect this portion of the lower peninsula are offering special inducements to purchasers of land. As a result, the current is now setting strongly in the opposite direction and sales of land lying within the pine belt for

farming purposes are constantly made. The sales at the State Land Office alone, according to information given at the office at Lansing, have averaged about twenty thousand to twenty-five thousand acres per month during the summer of 1882.

But whatever present advantages may be gained by this rapid transfer from the possession of the State and the railroad companies to that of individuals, a careful study of the facts of the case inevitably leads to the conclusion that undue inducements for the purchase and settlement of lands that cannot sustain a permanent population are greatly to be regretted. It may yet be found, it is true, that the plains are capable of sustaining such a population by the products of the soil. Some crop, yet untried, may flourish there, or some method of fertilization may transform them into fruitful fields, but, from all that is known of the conditions of successful agriculture, there is no reason to expect such a future for them.

There is one way, however, and at present there seems to be but one way, in which these and other waste lands in the same part of the State may be made permanently remunerative. They may be made to produce forests of valuable timber and a product of this sort, judging from the present demand, is likely to be worth many times as much as thin crops of grain that might be gathered from the soil during the entire period of its growth. From what has been stated already it is evident that, however unpromising the outlook may be for the growth of other vegetation, the plains are capable of producing several valuable kinds of timber trees, while the better lands around them have produced one of the finest natural forests that ever clothed the earth.

Over a large portion of this extensive region there is every reason to believe that the policy now pursued in the State of Maine, according to the forestry bulletins of the last census, of "cutting only the large trees and carefully protecting the remainder," would give at intervals a very profitable growth of pine and other timber, and it is to be earnestly hoped that before many years such a system may be inaugurated in Michigan. It will require a radical change from the present wasteful method of cutting everything that can profitably be turned into lumber and then leaving the ground to the destructive action of fire, but it is entirely practicable when once both State and people have come to realize its necessity and the profits to be derived from such a

system. Still, in order to attain the best results, by which is meant the greatest return of timber in the shortest time, it will be found necessary, over much of this territory, to resort to planting. This is especially true of the plains where most of the species now growing cannot be expected to yield a timber product nearly as valuable as would be derived from the planting of other and better kinds of trees. As soon, therefore, as any serious attempt is made to rehabilitate the denuded pine regions of the State, it will be necessary to know what species can be successfully grown there that will, at the same time, produce most rapidly, and with a minimum of expense, the most profitable returns. At present very few sources of information upon this important practical part of the subject are available. With the exception of what has been done on the grounds of the State Agricultural College at Lansing, no provision has been made for determining by actual trial what species are most available for planting, and conclusions based upon the results of experiments there may prove entirely misleading when applied to regions situated from one to two degrees farther north, with widely different conditions not only of climate but also of soil.

In carrying out a purpose to gather all the information now to be obtained on this subject, a visit was made by the writer, in the summer of 1882, to the experimental plantations of Messrs. Douglass & Sons, on the beach sands of Lake Michigan, near Waukegan, Ill. At this place the climatic conditions are decidedly less favorable than those prevailing over a large part of the lower peninsula of Michigan, the burning heat of summer and the severe cold of winter reach greater extremes, and the soil is of the poorest quality, yet, under these most unfavorable conditions, a young forest of valuable timber trees has been created and, under the intelligent management of the proprietors, there is every reason to expect most favorable results from the experiment.[1]

The trees that have been planted most extensively are the white pine, Scotch pine, European larch, hardy Catalpa and Austrian pine. A few other kinds have been planted but without satisfactory results further than to prove that they are not adapted to the situation. The Scotch and white pines have made a healthy growth and, though in many cases when set out they were

[1] I take this opportunity to acknowledge the courtesy of Messrs. Douglass & Son, and the information kindly given me while at their nurseries last summer.

"culls" unfit for sale, they are developing into fair-shaped, vigorous trees. The European larch, though frequently blistered by the intense heat reflected from the bare sands, when once started makes a vigorous growth, and the Catalpa, which has been tried, however, only two or three years, appears to be entirely hardy and to make a rapid and healthy growth. The Austrian pine often becomes diseased and is evidently inferior to either of the other pines for planting in such a situation. These plantations have been made only for the last eight years, but the results, thus far, are in the highest degree encouraging.

Without attempting to draw conclusions that perhaps can be fully established only after the continuance of such experiments for a quarter of a century or more, it seems safe to gather the following suggestions for our own guidance from the experiments at Waukegan :

1. The species to be particularly recommended for cultivation on the pine barrens of Michigan are the white pine, Scotch pine, European larch and Western Catalpa (*Catalpa speciosa*). Every one of these grows rapidly and produces excellent timber on land of the most inferior quality and in regions exposed to great vicissitudes of temperature.

2. Many kinds of trees, otherwise valuable, will not thrive under these unfavorable conditions, and it will prove a waste of time and money to plant them. The white ash and black walnut, for example, two of our best timber trees, require a better soil; the black cherry will grow, but, like the oak, will not attain full size on such light sand, and still others, such as the Ailanthus, that has elsewhere proven a useful species for cultivation, is not sufficiently hardy for our higher latitudes.

3. To obtain satisfactory results, planting rather than sowing, will have to be practiced. Sowing seeds on the burning sands and leaving them to take care of themselves results only in failure. Where the land is soft and can be marked readily by a wagon track, to aid the planters in distributing the trees rapidly and evenly, their planting can be undertaken at a minimum of expense.

4. The trees that have been recommended for cultivation grow more rapidly and attain dimensions suitable for use sooner than is generally understood. Specimens of white pine ten inches or a foot in diameter, that have been planted only twenty-five years, are not uncommon, and there are well authenticated instances of

the Catalpa having made an average annual increase of an inch in diameter, trees twenty-five years from planting having attained a diameter of two feet. Still it is to be borne in mind that these are cases of exceptionally vigorous growth, and at the best, the planting of trees must be considered a wise and liberal policy for the future, and not a source of immediate gain.

The facts, then, appear to entirely justify the conclusion that it is altogether practicable to rehabilitate the denuded pine regions of Michigan with valuable pine and other timber trees whenever the owners of the land, whether individuals, railroad companies or the State government, are ready to assume the responsibility and expense of the undertaking.

It would seem that the initiative in this great enterprise should be taken by the State. The traditional and distinctive spirit of our National and State institutions favors such intelligent provision for the future, and the example of such a State, in taking timely measures to provide for the future timber supply and instituting suitable experiments for determining the problems of practical forestry that are so soon to be thrust upon us, is a matter of no small moment. The experience of European governments, though in many respects not applicable in our own country, has conclusively established the desirability and necessity of a right position on the part of the government relative to this important interest. It is only through the decided and persistent intervention of the government of France that the fatal consequences of denuding her mountain regions have been in a measure averted, and practical operations of great magnitude and expense, which it is perfectly understood will require scores of years for their accomplishment, have been undertaken for the purpose of reforesting the denuded regions referred to. In the same country an extensive territory along the coast has been converted from drifting sands and unwholesome marshes into valuable forests, from which the government derives a considerable annual revenue, and a large population find their homes and means of living at the mills and other industrial establishments that have grown up there. Prussia is growing trees at a profit on extensive areas of sandy soil, described as being quite as worthless as that of the pine barrens of Michigan, and the government of Norway, with its extensive forests, from which the countries of the Old World have so long drawn immense quantities of lumber, is already purchasing land for the purpose of growing timber.

It is still to be seen whether any such providential measures will be adopted by the State of Michigan, the State that at present has more extensive lumber interests than any other in the Union. Should the subject receive serious attention at the hands of our legislators, there are two things that deserve special consideration—First, the fact that it is possible now, at slight expense, to retain under the direct control of the State, extensive areas of land, valuable for the purposes of forestry, that, so far as can now be seen, are worthless for anything else; second, *the exact facts that we must have in order to determine what to plant on the pine barrens of this State will have to be ascertained by actual experimental planting on those barrens*, and the sooner such experiments are instituted the sooner we may hope for the restoration, in part at least, of the forest wealth of the State.

——:o:——

ORGANIC PHYSICS.

BY CHARLES MORRIS.

(Continued from page 148.)

THE difference in character between different muscles becomes here a matter of importance, since each muscle is thus adapted to its special duty. In the striated voluntary muscles only those fibers respond which are directly acted upon by nerve energy. But their response is rapid and vigorous, so as to produce quick, energetic and localized motions. In the smooth muscles of the intestinal canal irritation yields a less vigorous result. But in them the energy is gradually communicated from fiber to fiber, so that a progressive muscular action arises, yielding the peculiar motion known as peristaltic. In the former case the fibers are energetic, but are insulated. In the latter they are less vigorous, but are in a degree uninsulated. In the muscles of the heart both these conditions exist. Its muscles are of the striped variety, and are very energetic. They are also completely uninsulated. The fibers are destitute, or nearly so, of sarcolemma, and inosculate with each other, so as to form an intricate fibrous network. This seems the most effective of all muscular arrangements for vigorous action. There is not only quick, but general response to every nerve excitation, though brought by but a single fiber. A slight impulse brought to a single muscle fiber is immediately disseminated throughout the heart, causing general

and powerful contraction. The chemical action is explosive, as in gunpowder touched by fire. It seems a special arrangement for the production of energetic action from slight contact influence.

There are other interesting features in this action of the heart. Each of its divisions is insulated from the others. The contraction of the auricles cannot be communicated to the ventricles, since they have no nervous or muscular connection. Each acts singly and successively. When the blood rushes from the vena cava into the auricle the muscles of the latter are relaxed, and the cavity readily receives the current. But the pressure of this inflowing blood affects the nerves in the walls of the cavity, quick and powerful muscular contraction ensues, and the blood is driven onward into the ventricle. The auricle, emptied of its blood and relieved from pressure, immediately relaxes. At the same time the ventricle similarly affected, contracts in like manner, and drives the blood into the arteries. The ventricle relaxes as the arteries contract, in response to a like influence. Thus by successive contractions and relaxations, induced by pressure of the blood current upon the nerve extremities, it is driven in successive pulses throughout the body.[1]

The heart has no opportunity for the long intervals of repose enjoyed by the remainder of the body. It, in company with the respiratory muscles, must be continually active. And yet it must have its intervals of sleep, however brief they be. If repair cannot accompany waste, it must have an opportunity to succeed it. The muscles of the heart have a sleeping and a waking period with every successive pulse. Contact with the blood current awakes them to action, rapid oxidation takes place, and at the same time nutrient molecules may exude from their blood capillaries into the tissues. With the cessation of the blood pressure the muscle cells sink again into repose, rapid nutrition takes

[1] The well-known fact that the heart of cold-blooded animals will continue to beat for a considerable period, when removed from the body, emptied of blood, and even nearly exhausted of moisture by desiccation, seems to militate against the above idea. Yet in such a condition air contact may replace liquid contact, while the pressure of the indurated membranes upon the nerve extremities may be sufficient to cause nerve and muscle action. It is known that the touch of cold air will induce peristaltic motion in the intestines when emptied of food. It is also known that the partly dried heart, when its contractions have ceased, may be made to resume them by a slight touch, thus showing the long continued sensitiveness of its nerves to contact.

place, while the products of previous oxidation are carried away, and new oxygen stored up within the cells.

Such is the systole and diastole of the whole system. Life has its instigating and governing agency in the contact of foreign matter with nerve extremities, the consequent oxidation of muscle tissue, and the resulting motor activity. It rests and repairs when contact ceases, or the exhausted nerves grow irresponsive. Without contact there could be no life. The body of man is a delicate instrument, played upon by the fingers of the universe, and responding in harmonious motions to the finest touch. But it must have its intervals of rest, in which its relaxed strings can be keyed up again to the concert pitch of active vitality. Could a sleeping body be so situated that no influence, either physical or mental, could act upon it, it could never waken. But it cannot be so situated. In the deepest slumber fine touches of exterior matter constantly seek the nerve extremities. In time the repaired frame grows again responsive. Now a touch calls a muscle into action. Now an impression makes its way through the brain to the mind. The heart, which had lost vitality through an excess of oxidation, during the day, has regained it by an excess of nutrition during the night. The blood current pours rapidly through the body, the animal energies break into full play, and the daily flow of the tide of life succeeds its nightly ebb.

Protoplasm, whenever so situated as to expose it to external contact, displays the general results above considered. The protoplasm of plants is as sensitive as that of animals, but ordinarily is covered with a more impervious coating, which hinders the communication of vibrations from cell to cell. It is also, probably, less freely permeated by oxygen. Yet leaves have general motions which are instigated, in most cases at least, by external contact. Many leaves move in response to the vibrations of light, and many others in response to touch. Possibly the seemingly definite motions of climbing plants may be thus instigated. In the meat-eating plants the contact influence is often conveyed to considerable distances, but these movements are usually deliberate, as if the partial insulation of the cells hindered their progress. The motor energy is propagated most rapidly in the line of the long diameter of the cells, in which direction there are fewer interruptions to its movement. Many plant motions are known to be due to a peculiar action of elastic cell membranes, and a forcing

out of previously absorbed water. This process, which is quite unlike muscular action, it is not necessary to here describe. It is sufficient to know that it results from a change in the character of the cell protoplasm, which is instigated by external irritation.

The final subject to be here examined is the chemical result of this continued oxidation. Degraded organic products must be continually formed. In the gland cells these take the character of special secretions. In the muscles urea is a marked product. But in all cells protoplasm must be reduced, and the most general products of this reduction seem to be the fats, and possibly the starches. Animal fat is doubtless partly derived from plants, but must also be largely of animal origin. In efforts to explain its appearance most anatomists incline to the opinion that clear protoplasm contains invisible or dissolved fat, and that this fat subsequently loses its solubility, and becomes visible as granules or globules. Such is the opinion of Sachs, Kolliker, Rindfleisch and others. But this does not explain its origin. It simply indicates the fact that fat granules constantly appear, with no evident source. Rindfleisch declares that there is no question but that this fat originates in the interior of the cells. Voit shows that fat and milk are formed from albuminous matters, and not from non-nitrogenous principles. Beale describes "milk as a dissolved organ of the body, and not a simple filtration from the blood." He elsewhere ascribes the fatty granules of the cell to death of the protoplasm. Other authors might be quoted if necessary, but the facts of fatty degeneration prove clearly that fat appears as protoplasm disappears, and in a manner to indicate that the former is a product of chemical change in the latter, not that protoplasm is an intimate mixture of albumen and fats, as some authors believe.

In all active animal cells minute granules appear. If nutrition be checked these increase in size, and plainly indicate their fatty nature. In cases of fatty degeneration, or the production of the ordinary fat cells, the conversion of protoplasm into fat continues. Finally the nucleus disappears, and only a spherical mass of fat remains in the cells. The sebaceous glands are constantly occupied in excreting it from the body. Occasionally the milk glands act similarly. Their function is a sort of temporary fatty degeneration of tissue.

Certain interesting experiments on starvation in plants and

animals, made by Dr. D. D. Cunningham of India, may be of interest in this connection. He shows that the result of starvation in fungoid plants is principally the conversion of protoplasm into fats, it being ultimately all thus converted. Starvation in animals causes a rapid increase of fat granules in the cells. These cells eventually break up, and discharge their oil globules into the blood serum. The change occurs with least rapidity in connective tissue cells, and most rapidly in active epithelial and blood cells. The protoplasm is converted into oil, at first granules, then globules. Then the cells disappear. Finally the intestinal epithelium disappears, and nutrition becomes impossible.[1]

In old age, when nutrition decreases, fatty degeneration is very frequent. This takes place most particularly in the non-vascular tissues. But it may effect all the tissues of the body, and even the walls of the blood vessels. Fatty metamorphosis always occurs in cases of disproportion between the means of nutrition and the parenchyma to be nourished, and may arise either from decrease of nutrition or increase of parenchyma. When a part is, from any cause, imperfectly nourished, fatty degeneration always occurs.[2]

It would seem, then, as if this was one of the normal results of animal activity. Oxygen incessantly attacks the tissues, reduces their albuminoid molecules, yields animal energy, and leaves fat as the general, and other substances as special, results of its action. Whether the decline from the albuminoid to the fatty stage of chemical condition is made at a single step, or by several successive steps of oxidation, at each of which it may be arrested by nutrition, is a question not easily settled. It is very certain, however, that a synthetic phase of chemical action opposes, or succeeds, this analytic phase. The molecules have been reduced chemically by oxidation. They are rebuilt by nutrition. But at what stage of reduction the combination with nutrient molecules takes place, whether at the fatty, or some earlier stage, is an open question. So far as indications go it would appear that protoplasm is directly converted by oxidation into a denitrogenized compound. Oxidation seems to take away its nitrogen radical, and nutrition to replace it.

The processes of plant activity become of interest in this con-

[1] Quarterly Journal of Microscopical Science, January, 1880.

[2] E. Rindfleisch, Manual of Pathological Histology, p. 40.

nection. Fats frequently appear in the plant cells, but starch, which occurs in limited quantities in animal cells, is the most abundant constituent of those of plants, and the mode of its occurrence is specially interesting. Whatever be the true process of carbon assimilation in the leaves, the fact that the starch product makes its appearance in the interior of cells, and that there is a chemical reduction of the cell protoplasm, is very important. Starch is not directly produced by the union of carbon with some sap molecule, but is apparently the result of some special cell metamorphosis, and on the character of this metamorphosis much light is thrown by Pringsheim's late researches into the nature and changes of chlorophyll.

The fact that assimilation takes place only in sunlight is particularly interesting in its bearing on the preceding hypothesis. We seem to have here a special case of contact influence. It is known that plants respire oxygen day and night. This oxygen is mainly employed in the plant interior in yielding force in aid of nutrition. But in the leaves it is otherwise employed, and here we have distinctive waking and sleeping periods. In the dark the whole plant sleeps; nutrition alone goes on. In the light the leaves awake; tissue oxidation is set up. It would appear, then, as if the contact or vibratory influence of the light rays was the agency which set up this special oxidation of protoplasm. Pringsheim has shown that if the light be very intense the oxidation grows so vigorous as to destroy the cells. If there be no light there are no oxidation products. The admission of light yields chlorophyll as its first resultant, this green coloring matter henceforth acting as a protective screen to the cell against the too vigorous action of the light rays. A somewhat later product is the readily oxidizable substance which he names hypochlorin.

These changes are appearently preliminary to the assimilation of carbon. The character of the subsequent changes is not very evident. The respired oxygen apparently effects a reduction of the hypochlorin to a lower stage, and may possibly set free a molecule having a vigorous affinity for carbon, sufficient to overcome its affinity for oxygen, and thus to decompose the carbonic acid molecule. However this be, one thing is certain: the oxidation that takes place yields a quantity of free energy. The sunlight which instigates oxidation, also yields, perhaps as vibration

of the cell contents, a quantity of free energy. The energy thus set free does not manifest itself as mass motion or as temperature. It is undoubtedly consumed in the formation of the starch molecules, and is one of the most important requisites to carbon assimilation. Thus, though the leaves possess the conditions which in animals result in motor activity, the energy set free by the oxidation of their protoplasm is but slightly thus employed, but is locked up in the starch product of assimilation.

In the economy of plant life starch and sugar (its soluble form) are the contributions of the leaf to the growth of the tree. The most important contribution of the root is ammonia, or some resultant nitrogen molecule. The result of the meeting of those two contributions we can but conjecture. There may be something analogous to animal nutrition, in which latter there is a degree of evidence that a nitrogen and a denitrogenized radical unite to form the albuminoid molecule. To this nutritive process oxidation is constantly necessary. The formation of the protoplasm molecule cannot take place except motor energy is supplied, and this energy is furnished by oxidation of some constituent of the sap current.

A rapid résumé of a portion of the argument here developed is desirable. This is in relation to the successive periods of rest and activity which affect all animal life, and which have been recently traced in the life of each separate cell. Each cell has its active and its resting periods. During activity changes rapidly occur, and division takes place. This is always followed by a period of quiescence; in which, perhaps, nutritive assimilation replaces the active oxidation of the preceding period. We may now trace more fully the true relations of the sleeping to the waking condition in animals. It is very probable that oxidation of organic substance never ceases within the animal body; but this oxidation takes two distinct phases, which may be termed primary and secondary oxidation, the former being the reduction of protoplasm, and requiring surface irritation, or its mental resultant, for its active operation; the latter being the reduction of hydrocarbons and other denitrogenized compounds, and acting under other conditions.

Oxygen is not used up in the body immediately upon its introduction. There is some storage process by which it is laid away until required. It has been shown by the experiments of Petten-

koffer and Voit that the expired carbonic acid is no measure of the oxygen simultaneously inspired. During the day the expired carbonic acid is considerably in excess of that due to the oxygen inspired. During the night the opposite is the case, more oxygen is breathed in than is expired. Thus a portion of the oxygen received during sleep seems to be retained in the body, for use during the waking period. It probably partly lies in the blood corpuscles, but it must also be largely laid up in the muscles, from their power of contraction long after removal from the body. Perhaps it is stored in all the protoplasmic tissues.

These facts lead to definite views concerning organic action. Nutrition and oxidation constantly go on, yet each has its two distinct phases. The primary phase of oxidation is accompanied by a secondary phase of nutrition. Protoplasm is oxidized and reduced. Part of the energy yielded is employed in the capture, mastication and digestion of food, its absorption and carriage by the blood, and its storage in the tissues, or in the cells.

During the resting or nutritive period these operations cease. Primary nutrition comes into play, and is aided by secondary oxidation. The products of primary oxidation are again attacked by oxygen, and some of their molecules still further reduced. But this chemical action yields an energy which aids others of their molecules to combine with the stored nutrient molecules, to the reproduction of protoplasm. This is the primary nutritive process. It is a process of double decomposition which is in close accordance with many inorganic chemical actions. There is a splitting asunder of one substance, whose sundered molecules combine with two other attracting substances, to the formation of two new compounds. In this process only a portion of the oxygen received during sleep is employed. The remainder is stored up in the protoplasmic tissues, for use during the waking period.

The true process of organic action may possibly be something like the following: The activity of protoplasm arises from the affinity of oxygen for its nitrogenized element. Oxygen permeates the protoplasm, but its affinity is resisted until vibration, induced by some external irritation, aids its attractive energy. Then the nitrogen molecule is attacked, and nitrogenized waste results. Urea is a constant product of muscle oxidation, and possibly of all oxidation of protoplasm. The denitrogenized remnant of the protoplasm remains in the cell. There are stored up in contact

with it nutrient molecules which possess nitrogen, but which need some slight change in condition to give them vital activity. This change is effected by the further decomposition of the denitrogenized product of the previous oxidation. Acted on at once by the affinities of oxygen and of nutriment, it breaks up into two new molecules, one of which combines with oxygen, the other with the nutrient molecule. The energy set free by the oxidation suffices for the purposes of the nutrition process. As a final result we have protoplasm on the one hand, and degradation products, of no further use to the body, on the other. Like urea—the nitrogen waste—this carbon waste is now removed from the body, and the tissues are once more free and in condition for a repetition of the active vital process.

Such, or something not greatly unlike this, seems to be the organic process. Life appears to result from the play of the affinities of oxygen for nitrogen and carbon. Combination of oxygen with nitrogen compounds sets the wheels of life in motion, yielding energy which is free to produce organic motion. Combination with carbon compounds winds up again the clock of life, and prepares for a new period of activity. But the affinity of oxygen for the organic molecules is resisted, and cannot take place effectively except when assisted. Vibratory impulse, resulting from external irritation, aids its affinity for the nitrogen molecule, and induces the active state. Double chemical action aids its affinity for the carbon molecule, which it can attack only by aiding in the reformation of protoplasm. Possibly it may have slight powers of attack when unassisted, but its vigorous action seems to require these aids. And in this fact we have a possible solution of the mystery of life, for it is to some such play of affinities that sensory and motor activities, and the production of new protoplasm, are due, and in this sense organic life is a result of oxygen affinities.

——:o:——

INDIAN MUSIC.

BY EDWIN A. BARBER.

THE Indian tribes of America possess to-day but a limited knowledge of the art of music, though the Chippewas are said to have employed, to a limited extent, some years ago, a method of notation which was, at least, familiar to the medicine men of the tribe. A manuscript, which the traveler Catlin pro-

cured from the Indians themselves, is composed of pictorial devices painted on birch-bark, and was produced on certain occasions to suggest to the mind of the performer the particular song which it represented. It is stated that some of "The North American Indians also use rude little pictures, rough writing we may call it, to help them to remember songs and charms. Each verse of a song is concentrated into a little picture, the sight of which recalls the words to one who has once learned it. * * * A picture of a circle, with a figure in the middle represents a verse of a love song, and says to the initiated, 'Were she on a distant island I could make her swim over.'"[1]

The musical instruments of the savage tribes of North America, however, were, and still are, of the most primitive sort, consisting of rattles made of wood, gourds, tortoise shells and the hoofs of deer, of bone whistles and of square or cylindrical skin-covered drums. Some of the savages of South America made flutes of the bones of wild animals, some of wood carved in the semblance of human heads, drums covered with the skin of monkeys and nondescript instruments made of variously-colored sea shells. One of the latter, which was exhibited at the last meeting of the Congress of *Americanistes* in Madrid, in the summer of 1881, was made of two parallel rods held together by eighteen shells, one end being ornamented with the jaw-bone of a man or monkey. The Indians inhabiting the interior of British Guiana still use rattles to accompany the music of the dance. In the Academy of Natural Sciences at Philadelphia are a number of interesting things from that country, in the valuable collection of the late Professor S. S. Haldeman. Several rattles are made of matting with black and white decoration. A conjuror's rattle consists of a large gourd with feather embellishments, and a painted and ornamented drum is covered at one end with the skin of a jaguar, the drum sticks resembling long lead pencils with large balls attached at one end.

It is necessary to look elsewhere for a higher development of the musical instinct in the Western continent. The ancient graves of the California coast have yielded a numberof primitive flageolets of bone, possessing, in some instances, four or five finger-holes, which, doubtless, were capable of producing a variety of notes.

[1] The Dawn of History. Edited by C. F. Keary, M.A., of the British Museum, London, 1878, p. 186.

In the cemeteries of Chiriqui, on the Isthmus of Panama, a large number of these unpretentious instruments have also been found, many of which have been elaborately molded from clay into representations of birds and animals.

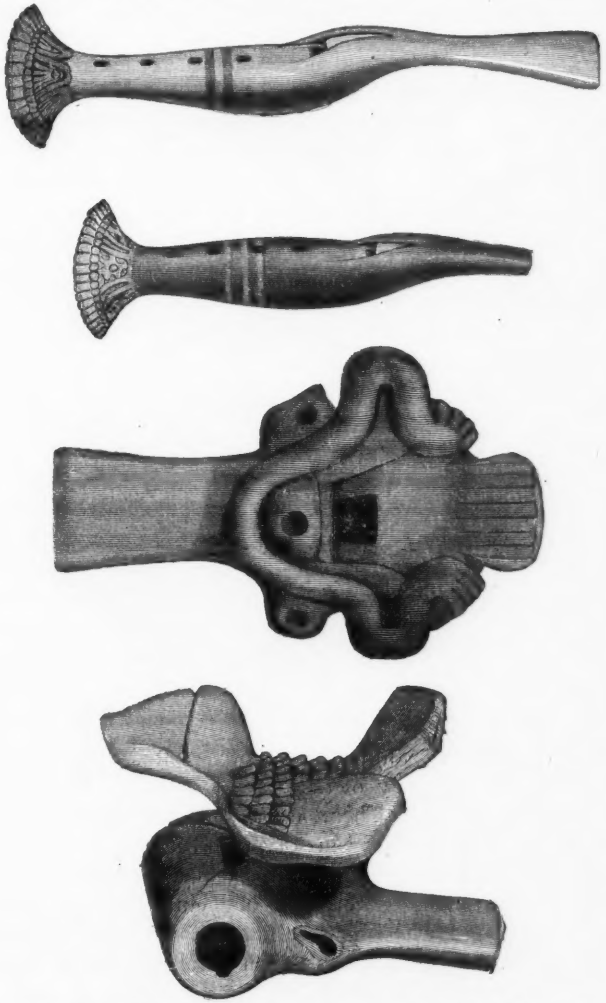


FIG. 1.—Mexican Wind Instruments: (clarionets and whistles) from the originals in the Poinsett & Keating Collection, Academy of Natural Sciences.

The ancient Mexicans used flutes, trumpets of sea shells and

other wind instruments. Several of these, now deposited in public museums, can be made to produce a series of notes in which the *fourth* and *seventh* are omitted, and certain authors have, therefore, reached the somewhat hasty conclusion that the Aztecs, Peruvians and other American peoples employed a peculiar scale of only five tones, to which they have given the name *pentatonic*. Instruments of percussion figured prominently in the religious ceremonies of the Aztecs, and the *huehuetl*, or huge drum, which was covered with the skins of serpents, could be heard for a distance of several miles when sounded on the great temple of Mexico. The Aztecs also made creditable wind instruments of clay. In the excellent collection of Mexican antiquities gathered together by the Hon. J. R. Poinsett and Mr. W. H. Keating in 1830, and now deposited in the Academy of Natural Sciences at Philadelphia, are a number of earthenware flageolets measuring

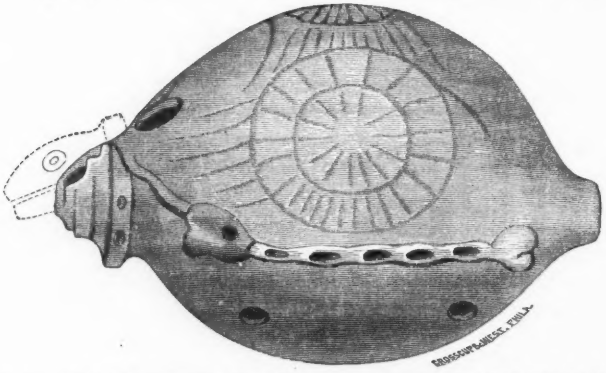
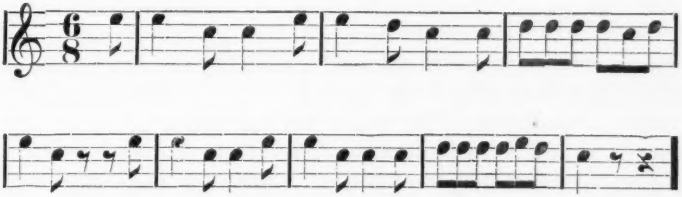


FIG. 2.—Curious Instrument from Ometkepec. From a drawing furnished by Dr. D. G. Brinton.

from six to nine inches in length and ornamented with brown and red paint. The majority of these are furnished with four, and some with five holes. There are also in the same collection many small clay whistles, some of them being wrought in the form of birds, serpents, heads of monsters and imaginary creatures of unsurpassable ugliness. They emit, in most cases, a clear, shrill sound when blown, though a few yield a peculiar noise like that made by the sudden escape of steam. One is composed of two tubes placed side by side, and gives out two distinct sounds.

Dr. Daniel G. Brinton has kindly furnished for this article the

drawing and description of a curious antique musical instrument, somewhat resembling a turtle in form, which was procured from the Island of Ometepec in the great lake of Nicaragua, by the late Dr. Berendt, during his recent excavations in Central America. It was found in connection with a shoe-shaped burial urn, with a quantity of roasted maize, is made of black clay, polished and ornamented with incised lines on the upper side, and possesses four holes arranged in a square on the lower. It was in all probability used by suspending it from the neck of the ancient musician by means of the two rings which project from either side near one end. When held in both hands, the lower part upward, the four holes being covered with the fingers, a variety of sounds can be produced by blowing into the neck or mouth. By a certain manipulation, a number of simple airs may be played, such, for instance, as the first part of "Yankee Doodle," and the following melody:

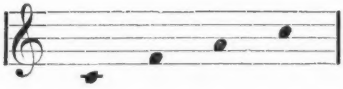


This unique relic is the first of the kind found amongst the remains of the old Nahuatl races which evinces any particular advancement in the art of music.

The Peruvians seem to have reached the greatest musical proficiency of any of the American races, and were also somewhat skilled in the mimetic arts. They were possessed of considerable histrionic ability, and combining their national songs with the drama, for the edification of their Incas, they produced rude operas, for which the principal actors were regularly educated. They made trumpets of baked clay resembling our modern bugle in form and which, possibly, were capable of being played in the same manner. They also had an instrument called the *huayra-puhura*, somewhat like the *syrinx* of the ancients, or Pandean pipes, which consisted of a number of hollow reeds or canes of varying lengths, fastened side by side, handled in the same manner as a mouth organ. One of these graceful instruments is preserved in

the British Museum, and consists of a double row of pipes which yield the following tones:

in which, it will be observed, the fourth and seventh are wanting; but another example in the extensive Peruvian collection of H. G. Clay, Esq., of Philadelphia, is made of four delicate reeds attached to a necklace of wampum, which emit the notes:



including the fourth, but omitting the seventh. Dr. Tschudi, in his great work on Peru, figures a syrinx composed of eight pipes, with a highly ornamented base and extra stops in the side.

Some of the modern Indians of Peru (the *Qquichua* and *Aymara* use a musical instrument somewhat resembling a flageolet (*qquena*), with which they make most melancholy music. Their *yaravis*, or tunes, are generally in the minor key, and when heard at a distance, or in the rarified atmosphere of the mountains in the night, are exceedingly impressive. Another instrument (the *chirimia*), a sort of clarionet, produces an even more melancholy music than the *qquena* and is generally played in concert of many instruments, while the latter is played in pairs. "The melodies played by these Indians," writes Señ. Don Frederico Blume, "are very peculiar and sentimental. It seems the performers are weeping over past glories. I was running the preliminary line for the Arequipa R. R., in 1861, and stopped over night at Quishuarani, a place (or rather the name of no place except a few huts scattered here and there among fig trees) some leagues below the village called Uchumayo, on the Arequipa or Chiri river. All at once I started in the midst of my sleep, roused by a terrific singing. After a considerable yelling which ended in a melancholy sigh, there followed a long *yaravi*, of course in the minor key, and then came another long, loud exclamation and then a most distressing *yaravi* again, and so on during the entire night. The news had just arrived by horse from Arequipa that the brother of the wife of Lecaros (in whose hut we were staying) was dead.

The announcement came, it seems, unexpectedly, and the explosion was that of a volcano of grief—terrible jets from time to time, then a quiet interval, and then again a great outburst, and so on. I have heard in Germany and elsewhere many masterpieces of music, but nothing to be compared with this dramatic and spontaneous opera. The exclamations were exclamations of grief, of pain, and the more quiet intervals were recitals of the whole life of the departed, by the sister, narrating how they had grown up together as children, how they had played and sometimes quarreled, and so on through later periods to the moment of receiving the news. His virtues and other qualities were reviewed and then grief overcame the woman and she cried out again, singing most distressfully.

"Thus I came to understand how their 'operas' originated and how natural a mode of expression they are."

Mr. Blume also states that the musical compositions of Peru may be classed under three heads: *yaravis*, *catchuas* and *catcharparis*, the two latter being used for dancing. "I saw at Totora," he writes me, "a grand procession at the funeral of a dead child. They had it adorned and tied to a shingle like a crucifix, but not with arms outstretched; and an Indian, holding the child high above his head in a vertical position, led the procession, which danced to the music of a weird song, from one village to another."

This ceremony and the accompanying music were said to be very ancient. In the north of Peru the Indians have an instrument made of a flute and a bladder—a primitive bag-pipe—and another, a sort of xylophone, made of a series of pieces of hard, sonorous wood.

The historian Garcilasso quaintly writes of the ancient Peruvians: "In Musick they arrived to a certain harmony, in which the Indians of *Colla* did more particularly excell, having been the Inventors of a certain Pipe made of Canes glued together, every one of which having a different Note of higher and lower, in the manner of Organs, made a pleasing Musick by the dissonancy of sounds, the Treble, Tenor and Basse, exactly corresponding and answering each to other; with these Pipes they often plaid in consort, and made tolerable Musick, though they wanted the Quavers, Semiquavers, Aires, and many voices which perfect the Harmony amongst us. They had also other Pipes,

which were Flutes with four or five stops, like the Pipes of Shepherds; with these they played not in consort, but singly, and tuned them to Sonnets, which they composed in meetre, the subject of which was love, and the Passions which arise from the Favours or Displeasures of a Mistress. These Musicians were *Indians* trained up in that art for divertisement of the *Incas*, and the *Curacas*, who were his Nobles, which, as rustical and barbarous as it was, it was not common, but acquired with great Industry and Study.

"Every Song was set to its proper Tune; for two Songs of different subjects could not correspond with the same Aire, by reason that the Musick which the Gallant made on his Flute, was designed to express the satisfaction or discontent of his Mind, which were not so intelligible perhaps by the words as by the melancholy or chearfulness of the Tune which he plaid."

The Bureau of Ethnology at Washington is now making preparations for the collection of data relating to the music and musical instruments of the various peoples of the new world, and many facts of an interesting nature will doubtless shortly be given to the scientific world in the hitherto comparatively untrodden field of native American music.

——:o:——

ON THE OCCURRENCE OF FOSSILIFEROUS STRATA IN THE LOWER PONENT (CATSKILL) GROUP OF MIDDLE PENNSYLVANIA.[1]

BY E. W. CLAYPOLE.

THE Catskill group of New York has been hitherto a great palæontological desert in American geology. Though much time and labor have been spent upon it by different geologists, little, I may almost say nothing, has thus far rewarded their labor. Here and there a few traces of life have been discovered, but these traces, faint and few as they were, have in many instances ended in disappointment, and now forty years after the establishment of the group by Professor Hall, the Catskill remains, even more than it was then, a great desert. The abundant life-remains that continue in New York to the very top of the Chemung there cease altogether. The abounding wealth of the Lower Carboniferous, especially in the West, sets in as soon

[1] Abstract of a paper read before the American Association for the Advancement of Science at Montreal, in August, 1882.

as the Catskill group is passed. But the Catskill group itself is a lifeless waste forming a complete break in New York and Pennsylvania between the Devonian and Carboniferous systems. Not a species, I believe, is known on both sides of it. The life of the Chemung in Pennsylvania died out and the life of the Lower Carboniferous came in, but the two faunas are distinct.

All the Devonian groups are connected by numerous species passing up from the lower to the higher, and often forming a high percentage of their total contents. But at the top of the Chemung this passing upward ceases. Even the two or three species of Testacea, formerly supposed to belong to the group, have been removed from it by the reference of the beds in which they lie to the Chemung or Portage.

It is worthy of notice that the equivalent beds in Great Britain have shown an almost equal poverty of organic remains. The Old Red Sandstone, or more properly speaking the Upper Old Red Sandstone (for it is incorrect to speak of the American Catskill as an equivalent of the whole of the Old Red Sandstone of England and Scotland), was for many years regarded as a desert, and so remained until by the labors of Hugh Miller, Charles Peach, Thomas Dick, Louis Agassiz and others, it was peopled with a fauna of its own—a fish fauna—of immense size and unique character. Sir Charles Lyell in his Elements says (p. 520): "For many years this formation was regarded as very barren of organic remains, and such is undoubtedly its character over very wide areas where calcareous matter is wanting, and where its color is determined by red oxide of iron." Even now the fauna of the Upper Old Red Sandstone is but scanty except in fish and plants; the few Testacea from the beds at Kiltorcan in Ireland, forming but a slight exception to the general rule.

In regard to the poverty of the American Catskill, Professor Hall remarks in the Geology of N. York (4th district, p. 283):

"Thus far we know little of the fossils of the Old Red."

And Mr. Vanuxem, speaking on the same subject says (Geol. of 3d district, p. 188):

"The fossils which have been observed in this group, in this State, so far, are but few in number, the group being very barren, and also in Pennsylvania where the rock has considerable surface exposure and great thickness"

Again: "Though shells and bones are rare in this group, plants appear to be much more numerous, accumulations existing

similar to those of the Ithaca and Chemung groups but in greater number and frequency, and giving rise to thin seams of coal, none of which, however, exceed a foot in length and breadth and an inch in thickness."

Professor H. D. Rogers (Geol. of Penna., Vol. I, p. 108) says of these same beds:

"This is a mass of very thick alternating red shales and gray and red argillaceous sandstones. It has very few organic remains. Among these is the Holoptychius and one or two other remarkable fossil fishes of genera distinctive of the Old Red Sandstone."

Professor Dana (Manual, 1874, p. 278) says:

"The rocks (Catskill) afford but few relics of life."

"Among animals, no corals, crinoids, brachiopods or trilobites are yet known. The coarse character of the beds accounts for their absence. There are some lamellibranchs and a Euomphalus,[1] these with fragments of fishes make up about all that is yet known respecting the fossil contents of the beds."

Mr. S. A. Miller, in his catalogue of the American Palæozoic Fossils, gives the following members from the Catskill or its equivalent groups:

Plants	7 species.	Gastropods	0 species.
Protista	0 "	Cephalopods	0 "
Polyps	0 "	Lamellibranchs	2 "
Echinoderms	0 "	Annelids	0 "
Polyzoa	0 "	Crustaceans	0 "
Brachiopods	0[2] "	Fishes	2 "

Assuming for the present the above list to be correct, it gives a total of eleven species in the animal and vegetable kingdoms recognized up to that date (1877) in the Catskill group.

A careful review of the above list of species with the necessary corrections to date will make a few changes both of addition and subtraction.

In the first place if we consider the plants, we find the following list of species attributed by different writers to the Catskill group:

Cyclopteris jacksoni Dn., Me., N. Y.
" *hallana* Dn., N. Y.
" *minor* Lsqx., Penna.
" *obtusa* Lsqx., Penna.
" *rogersi* Dn., Me.
Sphenopteris laxa Hall, N. Y.
Rachiopteris pinnata Dn., N. Y.
" *punctata* Dn., N. Y,
Lepidodendron gaspianum Dn., N. Y., Me.
Sigillaria simplicitas Van., N. Y.

[1] This statement appears to be erroneous so far as Euomphalus is concerned.

[2] *Atrypa inflata* Con., given as a Catskill species, is so entered by mistake. It belongs to the Catskill shaly limestone.

This is scarcely the place for a technical dissertation on the identity or distinctness of the species here represented by the names given above. But it may be briefly remarked that to *C. jacksoni* is attributed the specimen figured in the Geological Report of the fourth district of N. York. It is also reported by Dr. Dawson from Perry, Me. Of *C. hallana* the very existence is yet in doubt. Mr. Lesquereux considers it a synonym of the preceding, while Dr. Dawson makes it distinct. *Cyclopteris minor* and *C. obtusa* are the best known forms from the Pennsylvania Red Sandstone. *C. rogersi* rests, so far as Pennsylvania is concerned, on a doubtful fragment in the collection of Professor Hall, and *Sphenopteris laxa* Hall, is a synonym for *C. hallana* Goep., or *C. jacksoni* Dn. (if these are distinct). In this way we find there are only three species of the six named above, concerning which little doubt of their identity remains:

Cyclopteris jacksoni Dn. = *Sphen. laxa* Hall = *? C. hallana* Goep.
" *minor* Lsqx.
" *obtusa* Lsqx.

Add for the present to these, *Rachiopteris pinnata* Dn., and *Rachiopteris punctata* Dn., figured in the Geology of New York (3d dist., p. 191), and we have a total so far of five species reported from the Catskill group of Northeast America.

The Catskill Lepidodendron, of which a figure is given in the Geology of the Third District of N. York (p. 191), belongs, as nearly as can be determined from the engraving, to *L. gaspianum* Dn.

To these six species if we add the *Sigillaria simplicitas* of Vanuxem (Geol. of 3d Dist. of N. Y., p. —), admitting it, to avoid discussion, to be a plant, we have a total of seven species in all of vegetable remains from that part of the Devonian which has been considered to belong to the Catskill group.

Besides the plants there are a few relics of Testacea reported from this group, which we must notice. Two species only with numerous specimens have been assigned to it:

Modiomorpha augustata Vanuxem.
(*Cypricardites augustatus.*)
Modiomorpha catskillensis Vanuxem.
(*Cypricardites catskillensis.*)

Both are figured, but without description, in the Geology of the Third District of N. York (p. 186). But as the beds in which they were found have since been referred to the Chemung or even

to a lower group, there is no need to consider them farther. They must be cancelled from the Catskill fauna.

The only other fossils derived from any part of the Catskill group are fish remains, and these are the most important of all. From N. York and Northern Pennsylvania have been reported two or perhaps three species identified chiefly by scales. They are:

Holoptychius americanus Leidy.
Bothriolepis taylori Hall.
Sauripteris taylori Hall.

The first of these species rests solely on scales, and perhaps teeth; the second on similar evidence, the third upon a fossil fin. It is, however, more than probable that the second and third belong to the same species. In that case there are two well-marked forms of fish which compose the whole Catskill fauna of this country. These fossils have a special importance from the fact that both in Europe and America they are the characteristic fossils of the Upper Devonian. The various "fish beds" form the basal plane of the Catskill group of rocks. According to present knowledge all above the lowest bed containing Holoptychius is Catskill, all below it is not Catskill. Here is a clear sharp line, at present, marking off the uppermost beds of the Devonian from all beneath them—a floor, as it were, for the group.

Five plants then are all the vegetable remains that have been thus far reported on tolerably good evidence from the Catskill group, and even of this small number it is quite probable that critical study will eliminate some. Two species of fish in like manner constitute the whole animal kingdom of the Catskill rocks.

It is right to add here that Professor J. F. Whiteaves, of the Canadian Geological Survey has recently described some fish from the Upper Devonian of Scaumenac bay, which may prove to be of equivalent age to the Catskill of New York and Pennsylvania. "These fish-bearing beds," he says, "are immediately overlain by the sandstones and conglomerates of the Bonaventure formation of the Lower Carboniferous."[1]

The following species have been mentioned by Mr. Whiteaves from these beds:

Pterichthys canadensis
Phaneropleuron curtum
Eusthenopteron foordi.
Glyptolepis microlepidotus
Cheirolepis canadensis

[1] *Canadian Naturalist*, Vol. x, No. 2; also AMERICAN NATURALIST for Feb., 1883.

From the same beds Dr. J. W. Dawson has mentioned (Q. J. G. S., May, 1881, p. 301) three species of ferns, viz:

Archæopteris magnacensis
" *obtusa*
Cyclopteris brownii.

Should these beds prove to be of Catskill age, the five species of fish and two of the three ferns above named must be added to the organic remains of the group.

Lastly I must mention that quite recently the well-known Irish fern *Cyclopteris* or *Archæopteris hibernica* has been found and identified beyond doubt by Mr. Lesquereux from Susquehanna county, Pennsylvania.

In the district now under consideration the upper part of the Chemung group consists of greenish and yellowish shales, for the most part unfossiliferous or very scantily fossiliferous. Beds of red shale are occasionally met with but they are not thick. The passage to the Catskill group is somewhat abrupt. Red shale and brown sandstone suddenly form the mass of the rock, and afford a clear lithological base for these uppermost Devonian beds. They are apparently unfossiliferous for about 200 feet.

Above this occur two remarkable beds of brown sandstone charged with fish-scales. The lower of these two is about three inches thick and consists almost entirely of a mass of fish remains, chiefly scales, embedded in shaly sandstone rather harder than the over and underlying beds. The scales themselves are distinct in the rock but very difficult to extract on account of the crumbling nature of the stone. Their well-known impressions may be seen and often obtained, and so far as yet determined consist of the wrinkled scale of *Holoptychius americanus*, and the pitted scales of *Bothriolepis taylori.*

The upper bed lies about ten feet above the lower, is rather thinner, but abounds to an equal degree with the same organic remains.

These two beds—fish beds—afford us, so far as they extend, an indisputable palæontological base for the Catskill group in Perry county. These two species, as shown above, constitute nearly all that is yet known of the Catskill fauna, indeed it is scarcely too much to say that they may be regarded as the sole characteristic species of the group in America.[1]

[1] In Scotland Holoptychius passes up into the Lower Carboniferous, but the species in the two systems are different.

If, therefore, we assume these fish-beds as the life base, and the commencement of the red shale as the mineral base of the Catskill, the two are only about 200 feet from one another, and in the immense thickness of the group in Perry county—about 6000 feet—this difference is quite insignificant. We are then supplied with a clear horizon to which we can refer all that is found above these limits.

About 200 feet above the fish-beds occurs a thin bed filled with Spirifers of a species as yet undetermined but very much resembling the *Sp. mesastrialis* of Hall. The specimens are as is usual in the shale beds, much distorted, and consequently difficult of recognition. This bed is only a few inches in thickness, and the 200 feet intervening between it and the fish-beds is made up of red shale with a few layers of yellow sandy shale.

About 300 feet of red and yellow shales and brown sandstone follow, somewhere in which interval, though not yet detected along the line of section, is a bed of red sandstone containing remains of Brachiopods. This bed is indicated by abundant loose blocks lying about on the surface of the ground.

The most remarkable bed in the whole section comes next, lying about 500 feet above the fish-beds. It is a bed of light yellow sandstone not more than ten or twelve feet thick where exposed. Most of it is unfossiliferous, but it contains one or more irregular lenticular layers which were once crammed with shells and other organic remains. These have been entirely removed by solution, and there now remains a honeycombed mass of sandstone containing excellent casts of the relics formerly embedded there. The most abundant of these—and it occurs in millions—is a lamellibranch shell closely resembling, if not identical with, one described by Professor Hall in the Geol. of New York as *Cypricardia rhombea (Cypricardites rhombeus)*. Another less abundant species in the same bed as closely resembles *Cypricardia contracta (Cypricardites contractus)* of the same author. With these occur in less abundance remains of other lamellibranchs, crinoids and gasteropods which have not yet been worked out.

The bed above described has been traced over a considerable extent of country, and forms wherever it occurs a very convenient secondary horizon to which other beds can be referred.

The ground is in part concealed for a short distance above this point but where visible shows the same succession of red shale

and brown sandstone beds as already described. At about 300 feet higher—measuring at right angles to the bedding—occur two other fish beds, small when compared with those already mentioned, but equally distinct. The largest of them is only about half an inch in thickness, and the lower and smaller is a mere flake. They both show, however, the scales of the same genera, Holoptychius and Bothriolepis. These beds are useful as showing that these characteristic forms of the Catskill continued to live, and thus the beds already described, with their fossils, are hedged in above and below by remains of whose geological date no doubt exists.

Continuing above these second fish-beds, which are about two feet apart, we meet with a succession of beds of red shale and brown sandstone with a few greenish shaly layers until nearly 150 feet above them come in two or three thin green shales and blue limestone bands full of brachiopods and lamellibranchs of small size and species not yet determined. Another fossiliferous bed follows about twenty feet higher up. About 120 feet above this is a thin, soft, green shale full of a small Beyrichia and other fossils, and the section ends a hundred feet higher with a massive green sandstone containing a bed of vegetable remains almost forming a thin seam of coal.

We have, therefore, here a mass of strata, some of which are fossiliferous, extending nearly 1200 feet above the lowest Holoptychius bed, and nearly 1400 feet above the base of the red shale. This mass equals about one-fourth of the total thickness of the Catskill group in the county. It is right to add here that throughout this paper the terms Catskill and Ponent are used synonymously. The latter is, however, in Pennsylvania, the more definite of the two. Professor Rogers included in it all the mass of red sandstones and shales between the green Vergent (Chemung) and the Vespertine (Pocono) sandstone. In that sense the terms are employed here, without prejudice of future and further conclusions.

Whatever opinions may be entertained regarding the facts here detailed, they evidently guide us to one of the following conclusions:

a. That the lower portion of the Ponent red sandstone and shale (Catskill) is less barren of organic remains than has been supposed; or,

b. That Holoptychus and Bothriolepis are not exclusively Catskill forms;[1] or,

c. That an immense mass of the Ponent group must be removed from its present position and relations.

The fossils they contain belong apparently in part to the Chemung group below and the Lower Carboniferous group above. Another part is seemingly peculiar.

This is not the place to enter upon any discussion of the significance of the facts here presented. The following summary may, however, be useful and not without interest.

The Catskill group—that is, the rocks lying between the base of the lowest bed containing Holoptychius and the Lower Carboniferous or Vespertine conglomerate—have hitherto been known to contain only the following fossils:

Plants	5	Gastropods	0
Protista	0	Cephalopods	0
Polyps	0	Lamellibranchs	0
Echinoderm	0	Annelids	0
Polyzoa	0	Crustaceans	0
Brachiopods	0	Fishes	2 or 3

The beds here described of indisputable Catskill age supply the following results:

Plants		Gastropods	present [4]
Protista	0	Cephalopods	?
Polyps	present [1]	Lamellibranchs	present [5]
Echinoderms	present [2]	Annelids	?
Polyzoa	0	Crustaceans	present [6]
Brachiopods	present [3]	Fishes	present

Thus only the subkingdom Protista, the class of Polyzoa and perhaps the classes of Cephalopods and Annelids remain unrepresented in the Catskill group.

1. Polyps are represented by the genus Zaphrentis.
2. Echinoderms " " Crinoidal remains.
3. Brachiopods " " the genera Spirifera, Lingula and Rhynchonella.
4. Gasteropods " " the genus Pleurotomaria, &c.
5. Lamellibranchs" " " Cypricardites, &c.
6. Crustaceans " " " Beyrichia.

[1] See Proc. Am. Phil. Soc., 1883, "On the occurrence of Holoptychius below the base of the Catskill." E. W. Claypole.

PITCHER PLANTS.

BY JOSEPH F. JAMES.

THERE are two widely separated orders of plants known by the common name of pitcher plants, and they are perhaps, as widely separated in a natural classification as they are in their habitats. While one order is placed near the poppies and is a native of America, the other is allied to the birthworts or the Aristolochias, and lives in the swamps of Southeastern Asia, and the islands of the Malay archipelago. The first of these orders is known scientifically as Sarraceniaceæ, and includes but three genera; the other is Nepenthaceæ, with but one genus. Both of them are more or less familiar to persons interested in plants, and the latter always attracts attention by the peculiar appendage, like a bird's nest to the eyes of some, which is suspended from the tip of the leaf. It is to the first of these orders, the members of which are, with a solitary exception, natives of the United States, that this paper is devoted.

The genus Sarracenia, named in honor of Dr. Sarrazin, of Quebec, who first sent the plant and an account of it to Europe, comprises eight species, all but one of them being confined to the Southern States of our country. The one with the widest distribution, the well-known side-saddle flower, extends from near Florida, through the Atlantic Coast States to New England, and thence westward along the northern boundary of the country and in Canada, into British America. It lives in the cold swamps and bogs of the North, and its peculiar leaves and flowers have always been remarked by those who have collected or have seen them. The inside of the hood of the leaf is covered with a closely set mass of hairs, in all cases pointing downwards into the tube. In a state of nature these aptly named pitchers are often half filled with water; and the water is generally so crowded with insects, dying or dead, and decaying, that the air in a swamp where numbers of the plants are growing is very offensive.

At the junction of the hood to the main portion of the leaf, the hairs end abruptly, and the inside becomes very smooth and polished. This continues to about the middle of the pitcher, when another set of hairs is met with, this time not so stiff as at the top, but all of them still pointing downward toward the bottom.

This peculiar arrangement of a set of hairs at the apex of the leaf, of a smooth portion near the middle, and another set of hairs near the base, obviously serves some use in the economy of the plant. When the young leaves first open, there is no water found in them, but as they are so open and exposed to all rains and storms, they readily become partially filled with water. Now this soon becomes a mass of decayed animal matter. Insects fly, or fall into the tube, and once in, there is no egress. The fringe of hairs at the base hinders their walking, and even if this be surmounted, and the smooth stretch passed, the hairs on the hood, a veritable *chevaux-de-frize*, stops his onward and upward progress. He loses his foot-hold among the many hairs and falls hopelessly back to the bottom, to be eventually either drowned or starved.

It has often been a matter of surprise to see the number of insects in these pitchers, and it is more notably so because there seems to be so little to take them there; so little to induce them to tumble into the trap spread for them. But in thinking the matter over and taking into consideration one or two curious coincidences, it has occurred to me that this may be explained as follows: The flower is of a peculiar structure, is nodding on a naked scape, and the stamens with their mass of pollen are concealed behind the broad, peltate stigma, which forms, in fact a sort of reversed table. An observer, Mr. J. Jackson, Jr., has recorded (*Bot. Gaz.* VI, p. 242) that in examining a number of flowers, he has found the cavity between the inner surface of the stigma and the stamens, to be filled with flies, apparently eating the pollen. Fourteen flies were counted on one flower, and were, as he states, "in no hurry to vacate the premises." The suggestion I would make is this: If we suppose that there is something in the pollen, or in some secretion of the flower which has the effect of stupefying or intoxicating the insect, a not improbable supposition by any means, and then imagine a smart wind shaking the flower vigorously, would not the tendency be to shake the flies from their hold, partially stupefied as they are? They would drop to the ground, or else into the pitchers opened below them. These in their turn are admirably adapted to catch falling insects, for the hood is upright, and the cavity of the leaf fully exposed. The leaves too are spread out in a sort of rosette, quite close together, and all so inclined as to bring the opening in the most favorable

position to catch any falling object. What then is to prevent the leaf from securing its prey? And should it be so, it would be strange to find the flower used as a lure to bring food to the plant. It is said that a slight secretion has been detected about the orifice of the pitcher of this species, but Dr. Gray considers it to possess but little efficiency in securing the multitudes of flies sometimes found in the pitchers. The suggestion here made is, I think, worthy of consideration, and will not appear so very improbable when we come to other facts in relation to our subject.

Turning now to another species let us see what other facts can be learned, and see, too, what bearing they may have on the facts ascertained in regard to *Sarracenia purpurea.* The *Sarracenia flava* is a Southern species, extending from Virginia to Florida, and inhabiting the same swampy places which are the favorites with *S. purpurea.* The *flava* differs in a marked manner from the *purpurea.* The pitchers are much taller, stand more upright, and the lobe at the top is wider and more spreading. The inner surface of the hood has much smaller hairs, so small that it might be called a fine pubescence. But a still greater difference is found in the fact that there is a saccharine secretion found on the inner side of the hood, just above the junction of the lid with the rim. But there is something in regard to this secretion which is quite interesting. It has been stated by some observers, and it is thought with truth, that the secretion possesses intoxicating or stupefying qualities. As the insect feeds upon the matter it becomes dizzy, loses its hold on the surface of the hood, and falls to the bottom of the tube. Dr. Gray says in regard to this secretion at the orifice of the pitcher (*Am. Jour. Sci. and Arts*, ser. III, vol. 6; p. 149-50) that "This made its appearance at first in the form of minute drops, distinctly visible only under a lens; at length it forms flattened drops and even patches, distinctly sweetish to the taste and viscid to the touch." Mr. Brady, who observed the plants in North Carolina, says in regard to some pitchers of this species, "These, brought into the house, and kept fresh by the immersion of the base in water, showed the saccharine secretion most abundantly about a quarter of an inch above the junction of the lid with the rim. * * * * Many flies settled on the lids, and feasted on the saccharine narcotic. Evident signs of intoxication were manifested in each case, by their breaking loose repeatedly before tumbling into the gulfs." (*Am. Jour.*, ibid, p. 468.)

It is well known, as has been already noted, that the insects found in the leaves of the *S. purpurea*, meet their death by drowning, but with the *S. flava* the case is different. In regard to this Dr. Gray says (*Am. J.*, ibid, p. 149-50): "That the insects which abundantly fall or find their way into Sarracenia pitchers do not generally escape, but die and decompose there, is obvious. That more commonly they do not perish by drowning in *S. flava* is equally clear. While all the lower and gradually attenuated part of the tube is filled with dead flies in our plants growing in the house, there is only a little moisture at the very bottom. One would hardly think that the fine and sharp-deflexed bristles, which line the lower half of the tube only in *S. flava*, would greatly impede the return of a fly, they lie so closely against the wall of the tube. But I find that a house-fly, either large or small, when thrown into this lower part of the tube, is quite unable to get out, and there it perishes. Probably the advantage derived by the plant is equally secured, whether their prey decomposes in the moist air of the cavity or in the water in which they are often immersed."

This water, which is in the lower portion of the tube of *S. flava*, is also a secretion of the plants, for Dr. Gray and Mr. Canby found that "it distils in drops from the inner surface of the young pitcher, before the orifice is open." (Ibid, p. 149). The amount becomes afterward greatly increased by the rain which falls without difficulty into it.

There is, in a third species, this same sort of a secretion, with apparently the same stupefying effects. This is the *Sarracenia drummondii;* it has upright leaves which sometimes grow to be three feet in length, and they are peculiarly mottled with white spots. The hood has much larger and more conspicuous hairs than in the former species, and it is on this hood that the secretion is formed. Dr. Chapman, in writing to Mr. Canby, says: "On the inside of the hood, above its junction with the tube, there is a very faintly sweetish secretion scarcely perceptible to the taste, which is very attractive to insects; and, as I do not detect any of this within the tube, I wonder how it happens that so many insects are entrapped, since they could easily fly away from the open hood" (*Am. Jour.*, ibid, p. 468). Here again the stupefying qualities of this secretion are manifested, for it is after the insects have partaken of it that they are unable to fly away, and so fall into the trap.

Is there not good reason then for the theory I have advanced in regard to some stupefying matter in the flowers of *S. purpurea?* If the secretions of two species have poisonous properties, why should not that of a third have the same power? especially when it probably serves the same end in the economy of the plant, namely, that of providing insect food for it.

We come now to another species of the curious genus, the facts in regard to which are still more wonderful than those already given. This species is the *Sarracenia variolaris*, an inhabitant of the "damp pine lands," flourishing best on the edges of "pine-barren ponds" of Carolina and other Southern States. It differs in a marked manner from the other species noticed, inasmuch as the hood, instead of standing upright and leaving the orifice of the pitcher exposed, is bent over and shuts out most effectually any rain that may happen to fall. According to an excellent observer Dr. Mellichamp, of South Carolina (Pro. A. A. Adv. Sci., vol. 23, 1874), the leaf may be divided into three portions: "First, the inner surface of the hood or upper lid, marked on the posterior portion by white translucent spots and purple recticulations, which last extend forward and upward, and again downward on each side of the rim, for [supposing the leaf to be a foot long] a half an inch, or sometimes an inch." This embraces the internal honey-bearing portion. "Immediately below this, and extending for the space of three inches, there is an exquisitely soft and velvety pubescence, which under the glass is seen to be composed of very fine and thickly disposed retrorse hairs. This may be termed the second belt, and is so smooth as to afford no foothold for most insects. Below this again, the eye may detect a deeper colored pubescence, of a pale yellow or straw color, still smooth, but composed of coarse hairs, which became longer and more bristly as the tube narrows. At the base of this tube a watery fluid is secreted, into which insects are precipitated. This is the third belt and about five inches in length."

Examination of numbers of the young leaves, into which it was impossible for the rain to have found its way, revealed the fact that almost invariably there was some liquid to be found. This was sometimes but a few drops and at others as much as a drachm or even more. Experiments with this fluid brought to light some interesting facts. By great care, the experimenter collected about a half ounce of the liquid and experimented chiefly

with house flies. I give the results in his own words: "About a half drachm to a drachm of the liquid was placed in a small receptacle, and the flies thrown in from time to time, the liquor not being deep enough to immerse them completely, but enabling them to walk about in it without the risk of being drowned. Perhaps twenty flies were experimented with. At first the fly makes an effort to escape, though apparently he never uses his wings in doing so; the fluid though not very tenacious, seems quickly to saturate them, and so clings to them and clogs them as to render flight impossible. A fly when thrown into pure water is very apt to escape, as the fluid will 'run' from its wings, but none of these escape from the bath of the Sarracenia secretions. In their efforts to escape, they soon get unsteady in their movements, and tumble, sometimes, on their backs; recovering, they make more active and frantic efforts, but very quickly stupor seems to overtake them, and they turn on their sides, either dead (as I at first supposed) or in profound anæsthesia.

"I had no doubt from the complete cessation of motion, and from their soaked and saturated condition, that they were dead, and like dead men they were 'laid out,' from time to time, as they succumbed to the powerful liquor; but to my great surprise, after a longer or shorter interval, from a half hour to an hour or more, they indicated signs of returning life, by slight motions of the legs and body. Their recovery was very gradual, and eventually, when they crawled away, they seemed badly crippled and worsted by their Circean bath. After contact with the liquid, the flies first thrown in became still, seemingly dead, in about a half minute; but whether from exposure to the air or exhausted by action on these insects, the liquor did not seem to be so intoxicating with those last exposed to its influence. Anæsthesia or intoxication did not occur so quickly; it took from three to five minutes generally, and in one rebellious 'subject' it was at least ten minutes before he received his *coup de grâce*. A cockroach thrown in succumbed almost immediately, as did also a small moth, and much more slowly a common house-spider. On the recovery of the latter it was almost painful to witness his unsteady motions. Without doubt, therefore, the secretion found in the tubes of *Sarracenia variolaris* is intoxicating, or narcotic, or anæsthetic, or by whatever word we may prefer to indicate that condition to which these small insects succumb."

To still further test the qualities of this fluid, Dr. Mellichamp placed bits of venison in some of the Sarracenia secretion and some in pure water, and he found that in the former at the end of fifteen hours the meat was much more decomposed and gave out a much more offensive odor than in the latter; thus proving that the secretion possessed powers of decomposition.

Turning his attention then to the secretion on the hood of the pitchers, the observer found that it was best developed in warm weather, covering from a half to an inch of the surface. But he also found, what has not been found on any of the other species, "a continuation of the sugary exudation * * * glistening and somewhat viscid along the whole border or edging of the 'wing' —extending from the cleft in the lower lip even to the ground. There is, therefore, a honey-baited pathway leading directly from the ground itself up to the mouth, where it extends on each side as far as the 'commissures' of the lips, from which it runs within and downward, as before stated, for at least half an inch."

This exudation is not, it must be understood, an exceptional thing, but it is invariably found on leaves which are sufficiently mature and favorably placed in regard to the sunlight and moisture. And as showing the extensive use of this baited pathway, it is stated that ants, those prowling insects ever on the search for prey, are most frequently to be found in the pitchers. Further, it should be stated that this honey pathway does not seem at all to possess the anæsthetic qualities of the secretion at the bottom of the tube, but it simply acts as a lure. The flies would eat along the pathway and then enter the tube, either along the inner face of the hood or at the lower side. "After entering (which they usually do with great caution and circumspection appearently), they begin again to feed, but their foothold for some reason or other seems insecure, and they occasionally slip * * * upon this exquisitely soft and velvety 'declining pubescence.' * * * I have seen them," he continues, "regain their foothold after slipping, and continue to sip, but always moving slowly, and with appearent caution, as if aware that they were treading on dangerous ground." When attempting to fly they either strike against the hood, or the sides of the tube and keep falling lower and lower until they reach the liquid at the bottom where they become asphyxiated and at last take the form of the liquid manure which is utilized by the plant. Other experiments seem to show

conclusively that the honey of the lure possesses no intoxicating qualities, and that it is owing to the peculiar pubescence on the inside of the tube which prevents the insect from making its way out by crawling.

For instance, some of the tubes were split open their whole length and smeared with the honey. Then they were placed flat on the table, and a fly which had been smeared with the secretion so it could not fly, was placed upon the pubescent part of the tube. Mark the result: "The fly immediately made an effort to advance, but to my great surprise its most vigorous and persistent efforts availed nothing, as it slowly but steadily retrograded to the lower extremity of the tube! The experiment was repeated frequently, but always with the same result. It was as if a boat with insufficient propulsive power were steadily drifted back by a strong tide, only in this instance the tide seemed to be the polished retrorse hairs, made still more slippery by the fluid, with which also the insect was covered."

But while the large majority of the insects which are found in the pitchers of *S. variolaris* are there to die, there are two, a moth and a fly which live there almost altogether. These have some peculiar modification of the hairs on the legs which enable them to surmount the peculiarly pubescent surface. These insects are, of course, there only for the purpose of rearing their young, for they deposit their eggs, and the larvæ of one feeds on the decayed matter in the pitcher, and of the other upon the tissues of the leaf itself.

We have seen in the contrivances of these four species of Sarracenia a great diversity in order to secure the same end. That end will be evident with but little consideration. It must be for the nutriment of the plant in some way. When we study the Venus fly-trap, or the sun dew, we know that there is some benefit derived from the insect prey they capture. When we see the many marvelous contrivances in the flowers of the orchids, machinery arranged for the sole purpose of producing seed, we do not for a moment consider it chance, but know there is an adaptation of means to an end. And so, when we find in the pitchers of the species of this genus, such obvious traps for insects, we may feel assured that they are for some use. They can only be to supply the plant with nourishment, either as a liquid manure for the roots, transmitted through the cells at the base of the leaf, or else by

some absorbent glands, which takes the matter directly into the tissues of the plant. The probabilities are in favor of the former, or while large tubular cells have been noticed passing down through the base of the petiole into the root (Pro. A. A. A. S., vol. 23, 1874, Nat. Hist., p. 25), there have not been found, I believe, any absorbent glands on the interior surface of the leaf. It is very likely, as has been suggested, that as we find the leaves of Dionœa become less sensitive after a time, and cease to absorb matter, so the leaves of Sarracenia contain much more decaying matter than suffices for their use. This is made use of by various insects, for larvæ of different kinds are found in old pitchers, especially those of the *S. purpurea*. And birds are known to split open many of the pitchers and devour the insects inclosed. Finally, as Dr. Hooker says (Address before Brit. A. A. S., 1874, *Nature*, vol. x, p. 370), "the pitchers decay, and part, at any rate, of their contents must supply some nutriment to the plant by fertilizing the ground in which it grows."

Taking leave now of the genus Sarracenia, let us turn to another genus of the same family, the Darlingtonia, of a still more curious structure. This plant inhabits the bogs of California at an elevation of from 6000 to 7000 feet, and is limited to a very few localities. It was discovered as long ago ago as 1842, but it is so scarce and so few people have had an opportunity of observing it in a state of nature, that we know comparatively little about its structure and habits. What we do know is due to the observations of Mr. J. G. Lemmon and Mrs. R. M. Austin, of California, and to Mr. Canby, who has published an account of the plant. The tubular leaf is quite long, stands nearly upright, and has a peculiar twist, which no other species has. The hood, instead of being open as in *S. purpurea*, or simply covering the opening, is a vaulted arch, projecting over so far that the only entrance to the tube, in the largest leaves about an inch in diameter, is immediately beneath. In front of this opening are two very peculiar appendages, spreading out on each side, and likened to a fish-tail or a butterfly's wing. The top of the arch and the upper part of the tube is spotted in a peculiar manner with white spots.

This plant, like the others, secretes a sugary matter on the inside of the peculiar projections, which are also covered with bristles. And this sugary secretion, as in the *S. variolaris*, extends from the orifice, down the wing to the ground. The insects which are

principally found in these tubes are flyers, moths, etc., and in attracting these the peculiar fish-like projections are doubtless of great use. Besides being conspicuous from their size, they are brightly colored and peculiarly mottled. The moth, attracted by the conspicuous appendages, alights and feeds on the honey. Entering the tube, as it is almost sure to do, and afterward attempting to escape, it is prevented by the over-arching hood and falls into the tube. Here it finds the same sort of hairs described in Sarracenia, and is wedged deeper and deeper into the tube, to be finally drowned in the fluid secreted at the bottom. The peculiar twist is probably to wedge the insect more firmly into the tube, and make it more impossible than ever for it to find its way to the top. The peculiar white spots on the arch, and at the back, are supposed to be for the purpose of misleading the insect. The sun-light striking through them would make it appear a more conspicuous opening than the real one below, and by striking their heads against these simulated skylights they would be more likely to be knocked into the tube.

The flowers are solitary at the top of a bracted scape, of the color of the flap of the pitcher, and the organs are arranged in such a manner as to entirely prevent it being fertilized except by the aid of insects. Dr. Hooker, in speaking of these flowers, remarks that he was struck "with a remarkable analogy between the arrangement and coloring of the parts of the leaf and of the flower. The petals are of the same color as the flap of the pitcher, and between each pair of petals is a hole (formed by a notch in the opposed margins of each), leading to the stamens and stigma. Turning to the pitcher, the relation of its flap to its entrance is somewhat similar. Now, we know that colored petals are specially attractive organs, and that the object of their color is to bring insects to feed on the pollen or nectar, and in this case by means of the hole to fertilize the flower; and that the object of the flap and its sugar is also to attract insects, but with a very different result, cannot be doubted. It is hence conceivable that this plant lures insects to its flowers for one object, and feeds them while it uses them to fertilize itself, and that, this accomplished, some of its benefactors are thereafter lured to its pitchers for the sake of feeding itself!" (*Nature*, vol. x., 1874, p. 370).

Who can deny now that we have not to deal here with a marvelous order of plants? Every member of it has some peculiar

feature, and the means used to accomplish the same end is a striking instance of the diversity in nature. While in one species it is a poisonous honey which intoxicates the insect and causes it to fall into the tube; in another it is, perhaps, a poisonous secretion of the flower, which answers the same purpose; in a third, it is a baited pathway which lures the insect to destruction and a stupefying liquid which decomposes the bodies of the same; and in a fourth, it is the simulation of the wings of an insect, as well as honey and a baited pathway which attracts the prey. What doubt can there be, but that all these contrivances subserve the same end? And when, too, we consider the curious relation between the flower and the leaf in Darlingtonia, and the very different shape of the flower in Sarracenia, we see there must be still other facts to be discovered. Such an abnormal stigma as is possessed by the Sarracenia can not but be of some use. With its broad, flat table like expansion, most effectually concealing the stamens behind it, it is utterly incapable of self fertilization. There must be some relation between it and the leaves, but what this is, is at present a mystery. Then to trace the evolution of the leaves from the normal shape to the present peculiar one, would be of interest, but space forbids, and leaving this matter for some future time we take leave of this fascinating subject.

——:o:——

EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Owing to the almost isolated position of the United States as a nation, there is less stimulus to the development of a sentiment of nationality here than in the case of the European nations. Emulation and rivalry have had a great deal to do with progress in Europe. It has been asserted that the absence of such competition on this continent will work to the injury of the advancement of the United States, in matters intellectual at least. It is true that the character of our institutions is such as to stimulate the energetic prosecution of enterprises in all directions; but success here will only meet with financial rewards, unless there be some sentiment of national pride in the results of intellectual success, which is not directly connected with the making of money. For the successful discoverer in the field of pure science, Europe has greater rewards than America.

The recognition of work of merit, judged from the intellectual standpoint, must however begin with the votaries of such pursuits, for the general public cannot be expected of themselves to appreciate the situation. And here it is that American scientists are largely behind their European colleagues. It is true that our transatlantic friends are often, either through neglect or design, unjust in their preferences in giving credit to their own men, where it is due to those of other nations. But where but in America do we see the situation reversed, and credit given to foreigners when it is due to American brains and American thought? This is not now so much the case as it was formerly, but a serious defect still exists. American writers in the field of biology at least (we do not know how it is in the other departments), are by no means up to the sociological standard of Europeans in crediting their colleagues and countrymen with their work. The perusal of a German monograph is rendered doubly pleasing, from the constant references to other workers therein contained, as though the author were doubly anxious to credit others, and to avoid the appearance of appropriating as his own, the results of the ideation of other brains. There is policy as well as principle involved in this method. The author by exclusion shows what is original with himself, and in addition proves to the reader his familiarity with the literature of the subject. The same feature is usual in all works by first-class European authors.

This mode of treating the work of others is the result of social evolution, and it has reached a fuller development in Europe than in North America. It is no doubt, in part, a consequence of the greater number of scientists necessarily produced by several nations as compared with a single one, and from their frequent personal intercourse; and also from the sentiment of nationality which leads every one to desire to bring to light the best products of his country to the view of others.

—— The question of the "origin of the fittest" is claiming more attention in Europe than it did during the purely Darwinian period. We had occasion in the April, 1882, number of the NATURALIST to refer to the remarks of Professor DuBois Raymond in his lecture on Exercise, in which he traced the origin of some structures to the movements or exercises of their possessors. In a recent able exposition of the nature of the vertebrate skull,[1] Professor H. G. Seeley, of London, uses the following significant language: "* The only key to the history of these transformations is found in the law that function modifies, moulds and originates structures on the basis of antecedent organizations; * *."

[1] A paper read before the Science Society of Kings' College, London, Oct. 31, 1882.

Professor Grant Allen, in his book on the Colors of Flowers, in the Nature series, goes behind the law of natural selection in the following words:[1] "Not only can we say why such a color, once happening to appear, has been favored in the struggle for existence, but why that color should ever make its appearance in the first place, which is a condition precedent to its being favored or selected at all." * * "May we not say that it ought always to be the object of naturalists in this manner to show not only why such and such a spontaneous variation should have been favored wherever it occurred, but also to show why and how it could ever have occurred at all?"

As if to contribute to this view of evolution, Dr. Hubrecht, of Leyden, endeavors to show in a recent lecture, published in *Nature*, the importance of Acceleration as a factor in the development of organic forms.

—— The best advice to the biologist of the present day is that he should work as though time were eternity. The best work in art or literature is done by those who have a genius for patient, careful, thoughtful labor, expended on methods and minor details as well as in elaborating the central idea before them. The motto of the biologist should be *Festina lente*, and the charge on the field of his shield should be a turtle. Undoubtedly the Germans, whether botanists or zoölogists, are at the head of the world's workers in biological science. This is not so much because of their superior talent or genius, but because of their lack of nervousness and impulsiveness, which induces an admirable patience and a commendable slowness and calmness, and yet well sustained enthusiasm during their work. These qualities in minds of even average calibre, bring about excellent results. German monographs, despite their verbiage and prolixity, are nearly always solid contributions to science.

It may be well asked how far our American nervousness and impetuosity, and eagerness for immediate results impede or impair our success in scientific work of a high order. Our best naturalists have been those who have worked most thoroughly and with the least nervous haste. In the field of anatomy, histology, morphology and embryology, as well as physiology, the qualities of patience, lack of haste, and minute analysis are all important. Hence these departments of biology, which are naturally the most difficult, are the most disciplinary, the most exacting. Their pursuit places biology perhaps on a level with the purely physical sciences; and in these latter years of the second half century, biology has, with its instruments of precision, nearly, if not quite, gained a place beside mathematical and allied studies as an exact science.

[1] Page 119.

RECENT LITERATURE.

INDIANA. GEOLOGY AND NATURAL HISTORY.[1]—The report of John Collett, State geologist, forms a tolerably bulky volume, about equally divided between geology and palæontology. The geological portion is occupied with detailed accounts of the geology of Bartholomew, Delaware, Fountain and Shelby counties, and also contains the results of some carefully conducted experiments upon the transverse strength and elasticity of building stones, by T. H. Johnson. The specimens experimented upon were from the oolitic limestone, which forms a homogeneous bed forty feet in thickness, without clay partings, and is capable of furnishing the largest blocks that can be handled.

The palæontological portion contains descriptions of the species of fossils found in the Niagara group at Waldon, Indiana, by Professor J. Hall. The descriptions are accompanied by thirty-six plates of sponges, corals, crinoids, mollusks and trilobites, found in the above locality since its discovery in 1860, and descriptions of most of which have previously been published by Professor Hall in vol. IV of the Transaction of the Albany Institute, and in the report of the New York State Museum for 1876.

This is followed by a report upon the fossils of the Indiana rocks, by Dr. C. A. White, illustrated by nineteen plates, and including descriptions of three new species, *Pabella levettei*, *Bellerophon gibsoni* and *Agaricocrinus springeri*.

Mr. Collett has commenced this work energetically, and brought together results which will cause his next report to be looked for with great interest.

SMITH'S DEEP-SEA CRUSTACEA OF THE EAST COAST OF THE UNITED STATES.—This important report, published in the Bulletin of the Museum of Comparative Zoölogy, Cambridge, describes the decapod Crustacea taken mostly at great depths off the eastern coast from Martha's Vineyard to the West Indies. The descriptions are elaborate and detailed and the illustrations drawn with great care. The author gives no general results of his studies. A number of new genera and species are described.

WHITMAN ON THE DICYEMIDS.[2]—The Dicyemids are very peculiar organisms which inhabit the renal organs of cuttle-fish. Kölliker first discovered that these parasites produce two kinds of embryos, and for this reason gave them the name of Dicyema. Heretofore the most elaborate account of their embryology and classification has been that of Professor E. Van Beneden, in which,

[1] Indiana. Department of Geology and Natural History, Eleventh Annual Report. John Collett, State Geologist. 1881. Indianapolis, 1882.

[2] *A Contribution to the Embryology, Life History and Classification of the Dicyemids.* By C. O. WHITMAN. Reprint from the Mittheilungen aus Zoologischen Station zu Napels. IV. Band. 1 Heft. Leipzig. W. Engelmann, 1882. 8vo, p. 89. 5 plates.

however, he established for these strange beings a distinct subkingdom, the Mesozoa. It has been the general opinion, however, that they are degraded Platyelminth worms.

After an elaborate study of different species of this group, Professor Whitman considers their reproduction, embracing the phenomena of transition from the rhombogenic to the nematogenic condition, a comparison of the Dicyemidæ with the Orthonectidæ, and a general survey of their evolutionary cycle, so far as at present known. He then examines the development of the vermiform embryo, and the origin of the germ-cells, with remarks on endogeous cell-formation. Finally he discusses the systematic affinities of the Dicyemids. Whitman sees "no reasons for doubting the general opinion that they are Platyhelminths degraded by parasitism. Whether they and their allies, the Orthonectidæ, have descended from ancestors represented now by such forms as Dinophilus (Metschnikoff), or from the Trematoda (Leuckart), is a question which further investigations must decide," also remarking that "when we find an animal in the form of a simple sack, filled with reproductive elements, secured by position against enemies, supplied with food in abundance and combining parasitism with immobility, we have strong reasons for believing that the simplicity of its structure is more or less the result of the luxurious conditions of life which it enjoys, even if its development furnishes no positive evidence of degeneration."

VERRILL'S CATALOGUE OF NEW ENGLAND MARINE MOLLUSKS.[1]—This is intended to include all the mollusca now known to inhabit the New England region that are not included in Binney's edition of Gould's Invertebrata of Massachusetts, published in 1870. The illustrations are noteworthy, not only from the beauty and evident accuracy of the drawings which have been made by Mr. Emerton, but from the perfection and cheapness of cost of the photo-lithographic work.

BARRANDE'S SILURIAN ACEPHALOUS MOLLUSKS.[2]—In a thick octavo volume with ten plates, M. Barrande has given the results of his exhaustive studies of the genera of Silurian Acephala of Bohemia, of the vertical distribution of the genera and species, their variations and the specific connections established between the Bohemian forms and those of other countries.

BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY.—With the purchase of the Hall collection of New York fossils, and the accumulation or deposit of other material, and the accession of working scientists to its force, the American Museum

[1] *Catalogue of Marine Mollusca added to the Fauna of New England during the past ten years.* By A. E. VERRILL. (From the Transactions of the Connecticut Academy, Vol. v. Part 2.) New Haven, April to July, 1882. 8vo, 5 plates.

[2] *Acephales.* Etudes locales et comparatives. Extraits du système Silurien du Centre de la Bohême. Vol. VI. Acéphalés. Par JOACHIM BARRANDE. Prague et Paris, 1881. 8vo, p. 536.

of Natural History occupies a more substantial basis than before as an active scientific institution, advancing as well as diffusing natural knowledge. The numbers thus far published are solid additions to biology and would do credit to any institution. The articles are thus far all by Mr. R. P. Whitfield, the able curator of palæontology, and refer to the palæozoic fossils of New York, Iowa, Indiana and Illinois, besides his "Description of *Limnæa megasoma*, with an account of changes produced in the offspring by unfavorable conditions of life." The partly colored plate illustrating this essay, is a beautiful one. The most valuable palæontological paper is Mr. Whitfield's observations on the purpose of the embryonic sheaths of Endoceras, and their bearing on the origin of the siphon in the Orthocerata.

EMERTON'S NEW ENGLAND SPIDERS[1].—This brochure contains descriptions of the New England species of the family Theridiidæ, and is illustrated with twenty-four excellent photo-lithographic plates. These spiders are small and slender, spinning webs, often of large size, and living in them, hanging by their claws, back downward, and catching and eating the insects which become entangled among the threads. In many species the colors are plain, without any markings on the legs or abdomen. The amount of color varies greatly in individuals of the same species of certain genera; some being nearly white, and others nearly black. In other genera, the colors are bright and distinct. In most of the species there is considerable difference between the sexes, the males having the abdomen smaller, the legs longer, and the head higher than the females. Many details are given on the plates of the palpi, eyes, etc.

LACAZE-DUTHIERS' HISTORY OF LAURA GERARDIÆ.[2]—This elegant volume is devoted to the morphology, histology and developmental history of a singular crustacean which is parasitic on a coral. The work is a worthy successor of the richly illustrated monographs which the gifted author has successively given to the world, a series beginning with his treatise on the morphology of the ovipositor of insects, and containing those on Dentalium, the red coral and other important types. The illustrations are drawn by the author, whose facile use of the pencil is only equaled by his power with the scalpel, and we may add, the injecting syringe —the French anatomists excelling, we think, in making delicate injections of minute animals.

Laura is a parasitic crustacean, which externally is kidney-shaped and covered over by a growth of polyps of the antipatharian coral Gerardia. The body of the crustacean is covered by a

[1] From the Transactions of the Connecticut Academy of Arts and Sciences, Vol. VI. 1882. 8vo, p. 86.

[2] *Histoire de la Laura gerardiæ, type nouveau de Crustacé parasite.* Par H. DE LACAZE-DUTHIERS. *Institute de France.* Memoires de l'Academie des Sciences. Extrâit du Tome XLII. Paris, 1882. 4to, p. 160. 8 plates.

membrane or carapace, formed of two scales soldered on the median line. Externally the animal resembles a root, or sausage-barnacle. Within this singular membrane is situated the body of the crustacean, which is about a centimeter in length, the test or carapace being from two to four centimeters long. Laura is referred by the author to a new sub-order of barnacles which stands between the Rhizocephala and the true barnacles, though the Nauplius is very different from that of Cirripides, having no carapace.

THE MUNGOOSE IN THE WEST INDIES.[1]—In all the West Indian Islands the black and brown rats are cause of great loss to the sugar-planters, spite of rat-catchers, with the bow-string traps, and their aids in the shape of dogs and poison. Jamaica has also become possessed of the formidable and destructive *Mus saccharivorus*, an animal with a body ten inches long. To combat these pests, various animals were introduced, but the ferret succumbed before the attacks of the chigo; the Cuban ant (*Formica omnivora*), though it maintained itself and remains one of the planter's best friends, destroying the young of the rapacious rodents, also attacks kittens, puppies and calves, and the agua toad, devours young ducks, depopulates bee-hives and drives away sleep by its croaking, but does not eat rats. In 1872, nine mungoooses were brought direct from India and turned loose. In ten years these have so multiplied that they are abundant all over the island, and are now found even at elevations of 5000 feet. Cuba, Porto Rico, Barbadoes and Santa Cruz have also been supplied with these animals, and their first patron, Mr. Espent, has undertaken to ship some to Australia and New Zealand to combat the rabbit pests. As a rat-catcher this animal has proved itself worthy of its reputation, as it has reduced the expenses of rat-catching fully 90 per cent., and has reduced the quantity of rat-eaten canes to one fourth or one-fifth of what it was previously, representing an annual saving to the island of nearly £45,000. Nothwithstanding this benefit, the short history of the mungoose upon the island goes to prove that the introduction of a new species into a district should not be done rashly. The mungoose is now too common, and is making itself felt in other ways beside rat-catching. It to some extent preys upon eggs and chickens wherever dogs are not kept, and quail, wild guinea-fowl, game-birds generally, as well as sea and water-fowl, are rapidly diminishing before its attacks, as are also the yellow snakes, themselves good rat-catchers (*Chilabothrus inornatus*), and the ground lizard *Amiva dorsalis*). As the mungoose cannot climb a tree, the rats, especially the black species, take refuge in cocoa-nut plantations, and prove more destructive than formerly, but, on the other hand, the coffee and cocoa plantations profit greatly by its introduction.

[1] *The Mungoose on Sugar Estates in the West Indies.* By D. MORRIS.

WILSON'S WILD ANIMALS AND BIRDS.[1]—The boys and girls of this day as regards natural history literature, are, compared with their grandfathers and grandmothers, highly favored. The best zoological artists and engravers and naturalists of distinction vie in setting forth in word and picture the wonders of the animal world, and in retailing for the benefit of the rising generation of naturalists the latest views and discoveries in biological science. The young will never cease to read with eagerness anecdotes about or to study pictures of animals. They do not want to shiver over pictures of skeletons, or get sleepy over dry anatomical descriptions. The interest in living animals, the human-like countenance of the monkey, the ferocity of the tiger, the lion standing over his victim, the giraffe with his painfully long neck, the giant, clumsy form of behemoth, the mammoth proportions of the elephant, the horse in motion, birds in flight, fish swimming and snakes gliding—it is living, moving nature which captivates the child's imagination, and lends the study of nature unceasing delight—hence, zoological writers are among the children's best and life-long friends, and the annual visit of menageries are white days in his calendar.

What a contrast are the zoological pictures and books of this day to those we were brought up upon! Compare Oliver Goldsmiths' often apochryphal though pleasantly written natural history and Peter Parley's anecdotes of the animal kingdom, with the elaborate specimens of true art and faithfulness to nature, which the publishers of this day offer to the young. The child of three years, the urchin of ten summers, and the boy in his teens, all are offered books which for beauty of illustration and presswork are marvels of art.

An excellent example of what is excellent in artistic delineation of animals and in pleasant narration is Dr. Wilson's Wild Animals and Birds. The text is well and pleasantly written, and the latest authorities are cited or levied upon for material. Darwin and Wallace are often quoted; and Brehm's Animal Life and similar works are the sources of inspiration.

RECENT BOOKS AND PAMPHLETS.—Annales du Musée Royal d'Histoire Naturelle de Belgique Série Paleontologique. Tome VII. Description des Ossements Fossiles des Environs d'Anvers. Par M. P-J. Van Beneden. Troisieme partie. Cétacés. Brussels, 1882. From the author.

The New Zealand Journal of Science, Nov., 1882.

The Quarterly Journal of the Boston Zoological Society, Jan., 1883. From the society.

Scientific and Literary Gossip, Dec., 1882. S. E. Cassino, Boston. From the publisher.

Proceedings of the U. S. National Museum, 1882, pp. 433–448. From H. C. Yarrow.

Preliminary Report upon the Princeton Scientific Expedition of 1882. From Professor A. Guyot.

[1] *Wild Animals and Birds: their Haunts and Habits.* By ANDREW WILSON. Illustrated. Cassell, Petter, Galpin & Co., London, Paris, and New York, 1882. 4to, pp. 192. $3.00.

Surface Geology of the region about the western end of Lake Ontario. By J. W. Spencer, M.A. From the author.

On the Plumage of the Waxwing. By H. Stevenson, F.L.S. Ext. from the Trans. Norfolk Naturalists Soc., Vol. III. From the author.

Fifteenth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. Vol. III, No. 2. From the museum.

On the Loess and associated deposits of Des Moines. By W. J. McGee and R. Ellsworth Call. Read before the Iowa Academy of Sciences, May 31, 1882. From the junior author.

The colors of Flowers as illustrated in the British flora. By Grant Allen. London, MacMillan & Co. From the publishers.

Gardening for young and old. The cultivation of garden vegetables in the farm garden. By Jos. Harris. N. Y., Orange Judd Co. From the publishers. Also, from the same—

Colorado as an agricultural State, its farms, fields and garden lands. By W. E. Tabor.

The American Palæozoic Fossils. A catalogue of the genera and species and an introduction devoted to the stratigraphical geology of the Palæozoic rocks. By S. A. Miller. From the author.

The horizon of the SouthValley Hill rocks in Pennsylvania. By Dr. Persifor Frazer.

L'Epiplasme des Ascomycètes et le Glycogene des Vegetaux. Thèse presentèe pour l'obtention du grade de docteur agrégé pres la faculté des sciences de l'Université de Bruxelles. Par Léo Errera. From the author.

The Indiana Student, Jan., 1883.

The history of the Skull. By Professor H. G. Seeley. From the author.

Note sur des Ossements de la Baleine de Biscaye au Musée de la Rochelle. Par M. P.-J. Van Beneden From the author.

The Journal of the Cincinnati Society of Natural History, Dec., 1882. From the society.

Report of the Geological Survey of Ohio. Vol. IV. Zoology and Botany. From the survey.

——:o:——

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AFRICA.—Mr. Stanley has published a full report of the address he recently gave in Paris. From this we learn that he left his station at Vivi, below the Yellala falls, for a journey into the interior which occupied three years, and yielded splendid results. After launching his steamer above the cataracts of the Congo, he proceeded upwards to its great southern tributary, the Kwango, which he ascended for a considerable distance, establishing five stations. At one hundred miles from the mouth of the Kwango, two large streams, one with grayish-white water, coming from south by east, the other of an inky tint, from east by south, unite to form the main river. Ascending the latter and less rapid of the two, a large lake, seventy miles long and from six to thirty-eight wide, was reached at about 120 miles from the confluence. The shores of this lake were clothed with impenetrable and lofty forests, alternating with undulating grass lands, and the natives were very wild. Much of the road from Vivi down the Congo, past the long line

[1] This department is edited by ELLIS H. YARNALL, Philadelphia.

of cataracts to Stanley pool, about 150 miles lower down, has been constructed. The stations established on the Kwango are superintended by Europeans, who have all the apparatus for taking meteorological and other observations.

Major Von Meechow has returned to Berlin from the Congo, which he reached July 19th, 1880. After a visit to the grand Succambondu waterfall, under the guidance of the great chief Tembo Aluma, he paid his respects to the great Muene Putu Kassongo, and returning, followed the river to longitude 5° 5′ at which point he was compelled to return on account of the fears his followers entertained of the cannibals. He then stayed some time with Kassongo, and on February 20, 1881, arrived at Malange.

Dr. Wissmann, of the German African Society, has reached Zanzibar from Loando. Leaving the latter place in company with Dr. Pogge, he crossed to Mukenge (about 6° S. and 22° E.), and thence set out for Nyangwe on the Lualaba, whence Wissman proceeded to Zanzibar, while Pogge returned to Mukenge to plant a station there.

There are now four German expeditions in Africa, two proceeding from the east, and two from the west. Dr. Stecker, after visiting King John of Abyssinia, in company with Dr. Rohlfs continued onwards through the Soudan; Dr. Böhrn and Dr. Kayser report upon a three months' journey to Lake Tanganyika; Herr Paul Reichard is at Gondo, and in company with Dr. Bohrn, has explored the Wala river to its mouth; and Capt. V. Scholer, after founding a station at Kakama, proceeded to Zanzibar.

Robert Flegel has made a minute cartographical survey of the hitherto unknown part of the Niger, between Muri and Shay. At the beginning of December he reached Keffi on his way to the Binne.

Dr. Junker has cleared up the hydrography of the Welle, which he believes to be the upper course of the Shari, while the Aruwimi, the great tributary of the Congo, rises further to the east.

Asia.—In the course of his late journey from Canton through Yunnan to Bhamo, Mr. Colquhoun was enabled to collect much information regarding Yunnan, which is a great uneven plateau, the main ranges of which bend north and south, reaching northward an elevation of twelve to seventeen thousand feet, and sinking at the southern limit to seven or eight thousand. In the south and south-west are many fertile lakes and valleys, some with large lakes. These plains are rich and thickly peopled by a comfortable-looking peasantry. Pears, peaches, chestnuts, even grapes and other fruits are abundant, while camelias, roses and rhododendrons grow on the hill-sides. Silver, lead, copper and tin are abundant and caravans laden with them were often passed; while gold is beaten out into leaf in Tali, and sent in large quantities to Birma. Mines of coal, iron, silver, tin and copper were repeatedly seen. The temperature in the south is moderate,

without excessive rains, but to the north the country becomes sterile, and the population sparse, until in the extreme north fogs and rain are perpetually present. The people chiefly belong to aboriginal tribes, the Lolo Pai, and Maio, the Chinese being chiefly of the official class and resident in the towns.

The natives are frank, genial, and hospitable, and have a more distinct physiognomy than the Chinese. The women do not crush their feet, dress in a costume not unlike that worn of old by Swiss and Tyrolese maidens, and catch their husbands by throwing balls to the young men, who range themselves on the opposite side of a gully. Whoever catches the ball wins its thrower, but she always throws it so that the right man can catch it. The *couvade* is still practised in some parts, as in Marco Polo's time. When a child is born, the husband goes to bed for thirty days, while the wife looks after the work.

Mr. Colquhoun's journey was chiefly inspired by the desire to penetrate through the Shan States as far as Zimmè, a resolve in which he was unfortunately thwarted by the mandarin of the Chinese frontier town of Ssŭmao. He learned, however, that the Shan States are now entirely independent, since the Chinese withdrew their resident mandarin from Kiang-Hung six years ago, and the Burmese residents in this and other states were forced to retire within the last year or two. No tribute is now paid to either China or Burma. The most highly prized tea comes from the Shan States, especially from l-Bang, and is forwarded by caravan to the Yang-tzse, and thence by river to Shanghai, so that it is too dear to be exported.

The narrative of the travels of Count Szechenzi's party, which spent three years in Japan and China, and reached Rangoon in March, 1880, has been published. Little is added to geographical knowledge except altitudes taken in the Chung-tien plateau, within the great bend of the Kinsha-kiang. A map of the watershed of the great rivers is given. Upon it the Great and Little Irawadi are carried through the unexplored Pomi country to 32° N.; while the Lu-Kiang (Salwen) and Lantsan-Kiang (Me-Khong) are traced to 34° N. and 92° E., within a short distance of the valley of the Yangtze-Kiang. The basins of five great streams (including the Sanpu or upper Brahmaputra) are at one point crowded together into a space of 280 miles, and the water-partings are formed by a series of lofty ridges between Se-chuen and East Assam.

The journey of M. P. M. Lassar from Askabad to Sarakhs and thence to Herat, the capital of western Afghanistan, has proved that the supposed great mountain chain of Paropamisas is nothing more than a line of sand hills less than 1000 feet in height. Consequently there is no obstacle in the road of the projected Russian railway from the Caspian to Askabad, and from thence to Herat.

Mr. F. A Bourne has visited the Imperial Mausolea, east of Pekin, forbidden ground to all. The great wall forms the northern

boundary of the enclosure, which occupies some 25 square miles. Outside of this an outer wall is carried, except where there is no natural boundary, around a still larger area of ground within which none may build a dwelling and none be buried save the emperors of China. The tombs are much alike, and contain several stone buildings.

GEOGRAPHICAL NOTES.—A "Carpathian Club," for the study of the mountains of the country, has been formed at Hermannstadt (Transylvania) and already numbers 1200 members.——"Die Adria," a work in twenty-five parts, gives most valuable information relative to the geography, commerce, fisheries, etc., of the eastern shore of the Adriatic.——M. Miklukho Maclay has recently given a lecture before the Russian Geographical Society on his stay in New Guinea. The natives of the northwest coast, where he resided for a long time, were in the lowest stage of culture. They did not know how to rekindle a fire, and were compelled to borrow from another hut or another village when their fire went out. They place their dead in a sitting position, covered with cocoa-nut leaves, while for three weeks a fire is kept up beside the body till it is dried.——M. Maclay believes that the Papuans of the coast and of the interior belong to the same race. Both brachycephalic and dolichocephalic skulls occur everywhere, so that this feature affords no ground for a separation. The hair does not grow in clusters, as has been stated, and the size of the curls does not exceed that of the Negritos. On parts of the coast traces of Malay blood are evident. The Malays of Celebes bring with them Malay girls for wives to the Papuans, and take back Papuan girls in exchange. Lake Kamaka-Vallar is a lake of warm water without an outlet, but when the waters rise fifteen or twenty feet above the usual level a temporary outlet is formed by the giving way of the sides. The Papuans of the Koviay coast live in covered boats, in which they cruise in search of food, landing only at night for fear of the highlanders, whose enmity they have incurred by their former slave-making habits. The disease, drunkenness and firearms introduced by traders, and even by the missionaries of some societies, more than counterbalance the good done by the religious and secular teachings of the missionaries.——The Danish steamer Djimphna is reported safe, and will winter at the mouth of the Petchora. All on board are well, provisions ample, and the vessel uninjured by the ice while drifting about in it near Maigatz Island.——Dr. Riebeck, after exploring Socotra in company with Dr. Schweinfurth, has travelled through the Himalayas and various parts of India, and has taken many photographs and casts of the Hill tribes of the Karnasuli river.——A Chinaman, Huang Mao-ts'ai, has travelled in India, and published a book in which he accuses England and other European nations of acquiring territory by the three steps of "stealthily beguiling," "encroaching

by degrees" and finally "swallowing up," yet shows a high appreciation of English rule in India ——Dr. Arthur Krause has returned to Germany from a journey to the Chukchi Peninsula and Alaska. ——The ordnance survey of Scotland is completed. ——Easter Island is now almost entirely owned by the "Maison Brander" of Tahiti. It is a large grazing farm, and there are now about 10,000 sheep and 400 cattle upon it. Half wild poultry are abundant, and potatoes, bananas, and plantains grow readily. The natives left are only about 150 in number, as 500 were shipped to Tahiti about eight years ago, and the missionaries removed 300. The few left are thieves, without any religion.—— The extinct crater Te Kama Kao contains a lake covered with a carpet of decayed vegetation, and with no bottom at 50 fathoms in the centre.

GEOLOGY AND PALÆONTOLOGY.

PHYSICAL AND GEOLOGICAL CHARACTER OF THE SEA-BOTTOM UNDER THE GULF STREAM.—The longest and most interesting paper read at the late meeting of the National Academy of Sciences, was by Professor A. E. Verrill, discussing the physical and geological character of the sea-bottom off our coast, especially beneath the Gulf stream.

The paper embodied the general results of observations covering a period of eleven years, including dredgings by the United States Fish Commission, taken from over 2000 stations between Chesapeake bay and Labrador, and out as far as 150 to 200 miles off shore. Professor Verrill and his associates of the commission found in these observations that from the shore to a point about sixty miles out the water is inhabited by animals representing arctic life, similar to those found off the coast of Greenland, Spitzbergen and Siberia. Beyond this lies a warm belt of water which is inhabited by tropical or sub-tropical animals. This warm belt varies with the shore-line of the coast, and while its eastern edge is within sixty miles of Nantucket and Martha's Vineyard, it is much further off from the coast of Massachusetts and Maine; as what is known as the Gulf of Maine is a cold body of water, outside of which lies the warm belt. This warm belt is about twenty-five miles in width. In this the temperature from a depth of 65 fathoms out to the limits where the soundings show a depth of 1000 fathoms, is from 46° to 52° Fahrenheit near the surface, decreasing in temperature in the lower soundings, until at 700 fathoms it is 39°. In the cold belt the temperature of the water ranges from 35° to 45° in August below the surface water, which is in the autumn warmer than that underneath. The temperature at 40 fathoms in the cold belt averages from 35° to 37°. In the warm belt the temperature at 65 fathoms is 46°; at 100 fathoms, 50° to 52°; at 200 fathoms, 48°; at 300, 40°; and at 700, 39°. As a result of the soundings, measurement of tempera-

tures, etc., it was discovered that an error exists in our maps and charts in placing the warm belt, or Gulf stream, too far from the shore by thirty or forty miles. It was also found that the soundings even on the coast survey charts were inaccurate by hundreds of fathoms in many instances, which are now, however, corrected by the coast survey soundings made during the past summer. The general accepted theory has been that the 100-fathom line marked the line of the Gulf stream, but this was found to be incorrect, as the line would be more nearly correct if placed at 65 or 70 fathoms line. The charts are also incorrect in that they make out a difference in the line of the Gulf stream in summer and in winter. Professor Verrill held that there was no variation in the body of the stream, though there is in the surface water an apparent variation, due to the sweeping in of the warm surface water in the summer and the diffusion of the cold surface water over the stream from the shore during the cold months. The proof of his theory is the fact that the sub-tropical life exists in the Gulf stream in winter as well as in summer, while the character of the inhabitants of the cold belt remains unchanged the year through, and the line of separation between the two kinds of life is well and distinctly marked on the bottom. If there was a variation in the bottom of the stream there would be death to the sub-tropical life of the warm belt.

In the portion of the warm belt south of the New England coast, from 70 to 120 miles from the coast, there was discovered, in 1880, the most valuable ground for the sub-tropical animal life, as prolific in invertebrate animals as any in the world. From this ground the dredges have taken and brought to the surface 800 species of animals, over one-third of which were entirely new and unknown to science, including 17 kinds of fishes, 270 of mollusks, and 90 of crustacea. The recent observations of the Fish Commission have been made in a warm belt extending about 160 miles from the north-east to the south-west, and about 20 miles in width. Over 130 dredgings were made in this belt at a depth of 100 fathoms. At about the 100 fathom point the formation of the sea bottom is peculiar in many respects. To this point there is a gradual descent from the shore. Then there is a precipitous descent to soundings of 1000 fathoms or more, the sudden precipitous descent corresponding to about the height of Mount Washington along the territory that has been explored. The warm belt seems to extend down this precipice only to a depth of about 125 fathoms, judging from the evidence of life brought up in the dredges as well as the thermometrical records. A trawl had brought to the surface in several instances a ton of animal life, which included crabs, shrimps, starfish, and shells of various kinds, among them shells which had hitherto been found only on the shores of the West Indies, but which are now known to be inhabitants of the warm belt of water running along the

Atlantic coast. The surface inhabitants are also tropical in their nature, as is shown by the capture of argonautas, Portuguese men-of-war, varieties of the jelly-fish, and pteropods in large quantities. A peculiarity in the weather was noticed by the people engaged in dredging, for while it was pleasant out on the warm belt, they had found, on their return to the shore, that a storm had been raging, which had caused their associates on shore anxiety as to the safety of their steamer, the *Fish Hawk*, and the people on board.

The quality and quantity of the light in the depths had not yet been ascertained, but some marked peculiarities have been noticed. Many of the crabs and other animals caught have been found to have the eyes very largely developed. Other animals, which live at greater depths, have been found to be without eyes, presumably a useless organ in the great depths. Another peculiarity observed about the animals found at great depths is that their color is either red or an orange yellow, this being the case with the corals, anemones, fish, and such animals as are exposed to attack from voracious enemies. It is therefore inferred that the color is a mode of defence, in that it renders the animal invisible in the greenish-blue water, and the similarly colored rays of light which can only reach to those depths, and so render a red coat a means for its wearer to keep out of sight of its enemies. The bottom of the Gulf stream is very peculiar. That of the Arctic belt is a coarse gravel or sand. That of the great depths a sticky mud. Under the Gulf stream the bottom is of sand of so fine a grain that the grains can only be distinguished from one another under the microscope. This packs together so compactly that the sailors who find it clinging to the sounding leads call it mud. Yet it is the finest grade of sand, very cohesive in its nature. Mixed with it in great quantity are masses of the most minute shells. The two seem to form a bed as level and hard as any floor, and, judging from the results of dredging, this floor is carpeted thickly and densely with masses of vegetable and animal life. Boulders are occasionally found on this bottom, and these, the professor thought, had dropped from cakes of ice that had floated out from the shore. There are also brought out by the dredges occasionally a different form of rock, which seems to be indigenous to the bottom and filled with fossil shells, many of which are exactly like the shells now found on the bottoms. These rocks, he thought, might possibly date back to the Pliocene age, but possibly only to the Post-pliocene. Their appearance in the dredges he presumed to be due to the fact that they had been loosened from their beds by the burrowing fishes and animals and then caught up by the dredges.

In connection with the character of these fossil rocks, he had noticed the absence of all vertebrate fossils. The dredges, too, had never brought up any evidence of the existence of dead ver-

tebrates, though the water swarmed with myriads of sharks, dolphins, and other vertebrates, nor had any evidence of the existence of man been brought up in these dredges, and nothing of consequence of man's work except an India-rubber doll, that had been dropped overboard from some vessel. Yet the territory dredged was in the track of the European vessels, and where ships have gone down and lives been lost, but everything of this character is destroyed by the voracious animal life of the tract. These facts led him to doubt the negative evidence in geology, and the absence of vertebrates among the early fossil remains found does not lead him to conclude that the mammals did not exist at that time, as their remains might have been destroyed by the animals that have been found in the rocks, as are all evidences of vertebrates in the tract they had been dredging, although it is well known that such animals exist in myriads in the waters above. The presence of broken shells in large quantities on the bottom, he said, was due to the fact that carnivorous crabs and other animals eat the bivalves and univalves alike, cracking up and throwing away the shells. He also stated that the bivalves were food for the cod, which digests out the meat and then spits out the shells. —*Scientific American.*

The Tertiary Deposits of the Atlantic Slope.—The last volume of the proceedings of the Philadelphia Academy of Natural Sciences contains a valuable paper by Professor A. Heilprin, upon the relative ages and classification of the Post-eocene tertiary deposits of the Atlantic Slope, particularly of Maryland, Virginia and North and South Carolina. These were considered by Mr. Conrad to be of one formation, which he usually regarded as Miocene, but at other times thought to be the equivalent of the British Crag, now usually believed to be Pliocene. Mr. Conrad concluded that his Miocene strata represented "one contemporaneous sea-bottom," although he noted that the strata of North Carolina contained a greater proportion of recent to extinct forms than those of Virginia or Maryland. Lyell noted the same fact, but did not institute a comparison. Professor Heilprin gives full faunal lists of the mollusca, from which he obtains the following results: The deposits of South Carolina contain 35 to 38 per cent. of recent forms, those of North Carolina 26 per cent., those of Virginia 11 per cent., and those of Maryland 12 per cent. The Maryland deposits may be divided into a newer and an older, the former of which contains 16, the latter 4 per cent. of recent species. From these data Professor Heilprin concludes that the North and South Carolina deposits represent approximately the same geological horizon; and that the Virginia deposits are lower and older and coincide with the upper deposits of Maryland. The Maryland deposits almost certainly represent two faunal horizons, and the same is probably the case with those of Virginia. The Maryland and Virginia faunæ, from their small percentage of living

forms, are doubtless Miocene, but these of North and South Carolina are more difficult to pronounce upon, yet, on the whole, Professor Heilprin is of opinion that they should be classed as upper Miocene rather than as Pliocene.

The Atlantic Miocene may therefore be considered to form three groups: First, the Upper Atlantic Miocene or Carolinian, of the North and South Carolina deposits; second, the Middle Atlantic Miocene or Virginian, and the newer group of Maryland; and third, the older group of Maryland, and possibly the lower Miocene beds of Virginia.

A NEW FOSSIL SIRENIAN.—At a recent meeting of the Philadelphia Academy, Professor Cope read a paper on Dioplotherium, a a new genus of Sirenia from the Miocene beds of South Carolina. The form is allied to Halicore and Halitherium, but differs from both in the possession of two incisive tusks in each premaxillary bone. The anterior tusk is large and compressed towards the apex; the second is not much smaller than the first. The premaxillary bone preserved indicates an animal not smaller than the dugong. It was named *Dioplotherium manigaulti* in honor of Mr. Gabriel Manigault, director of the Charleston Museum.

THE GEOLOGICAL STRUCTURE OF SOUTH AMERICA.—Professor Orville Derby, director of the Geological Survey of Brazil, has given an instructive general view of the geology of Brazil and its relations to that of the southern continent.[1] He first directs attention to the two primitive islands, round which the continent grew. These are the archæan regions of Eastern Brazil and of Guiana, which now consist chiefly of mountain ranges. Between these the Amazon region was represented by two gulfs, the one opening to the east and the other to the west, and connected by a wide strait at the point of closest approach of the *terræ firmæ* above mentioned. These islands were, according to Professor Hartt, Professor Derby's predecessor, elevated during the early part of the Silurian period. Their materials represent three periods, the Laurentian, Huronian and Lower Silurian.

In the Palæozoic sea were deposited successively formations of Upper Silurian, Devonian and Carboniferous ages. They are all well represented by fossils, of which many are identical with species of corresponding periods of North America. The Upper Silurian is about 1000 feet in thickness, the Devonian has not over 600, and the Carboniferous 2000 feet, according to Mr. H. H. Smith of the survey. They are exhibited on both sides of the Amazon valley, and are best seen in the cuts made by the numerous tributaries of the great river. The Devonian is divided into three subdivisions, two of which correspond to the Corniferous and Hamilton of North America respectively. The Carboniferous represents the Coal measures, and is very rich in invertebrate

[1]Proceedings American Philosoph. Society, 1879, p. 155.

fossils, more than one hundred species having been obtained up to 1879. More than half the species are identical with those of the Western United States. During the Paleozic periods enormous deposits were laid down in the Andean region.

The Cretaceous beds occur chiefly on the eastern sides of the primitive archean islands. North of the Amazon they fill the basins of Pernambuco and Sergipe, and south of it, one between Salinas and Bragança. In the Amazon valley they are certainly known from the flanks of the eruptive mountains of Ereré on the north side of the lower Amazons, and according to Chandless, in an extensive area on the river Purus in the middle or Solemoëns drainage area of the Amazon, on the southern side. At Ereré they are only three hundred feet thick. Towards the close of the Cretaceous period the great ranges and plateaux of the Andes were elevated, closing the mouth of the western gulf, and converting the Amazon valley into a Mediterranean sea, with probable outlets to the north and south, as well as to the east.

The lacustrine beds which cover the Amazon valley and even the paleozoic lands on its borders, are of various character, and have not been thoroughly explored. Those of the lower Amazon are tertiary, and are 1000 feet thick, and contain no fossils. Those of the Upper or Marañon basin, as observed at Pebas Equador, are of Laramie or Upper Cretaceous age, and contain the invertebrate genera characteristic of the Bear River group of North America. The immediate valley of the Amazon is filled by a fluviatile deposit, the "varzea," which undergoes constant changes, due to the movements of the river and its tributaries.

Plutonic phenomena were especially frequent during the paleozoic periods. This is attested by numerous masses of diorite and trap which traverse those beds, and by the elevation of the mountains of Ereré, in the lower Amazonas, already mentioned.

Geological News.—In the November number of the *American Journal of Science*, J. W. Dawson notes recent discoveries in the Devonian Flora of the United States, discusses the nature and affinities of Psilophyton, a lycopodiaceous genus, and mentions the occurrence of five species of conifers in the Middle Devonian.

In the same number W. Earl Hidden contributes notes on various North Carolina minerals, and Professor Silliman writes upon the Martite of the Cerro do Mercado, or Iron mountain, of Durango, Mexico. This hill, a mile long, a third of a mile wide, and four to six hundred feet high, rises abruptly from the plain on which the city of Durango stands, and contains one or more immense, nearly vertical beds of specular iron ore, masses of which are scattered all over the surface, and have given rise to the idea that the entire mountain is formed of iron. The indications are that the deposit extends far beneath the plain from which it projects. The near approach of the railway system of Mexico promises to give this mass of ore a commercial importance.

——The previously noticed paper upon Earth Movements, by Professor J. Milne, of Tokio, Japan, appears in the *Geological Magazine* for November, and the same number contains the following: Remarks on some remains of plants, Foraminifera and Annelida, in the the Silurian rocks of Central Wales, by W. Keeping: six new plants, and *Myrianites lapworthii*, an annelid, are described.——The Rev. A. Irving continues his notes on the Dyassic and Triassic rocks, and Professor E. Hull answers some of his previous statements.——The evidence of the angular drift in favor of a great post-glacial flood is continued by Mr. H. H. Howorth, who asserts that the marine drift will lend him further support. ——The December issue of the *Geological Magazine* contains: Notes on *Oreaster bulbiferus*, from the Upper Chalk of Kent, by P. Herbert Carpenter.——A notice, the third in order, of fish remains from the Blackband Ironstone of Borough Lee, near Edinburgh, by Dr. R. H. Traquair. Four selachians, a dipnoan and three ganoids, are described.——The fallacy of the theory of the "Permanence of Continents," by J. S. Gardner. Mr. Gardner maintains that Mr. Wallace's supposition that the chalk is a shallow water deposit, is untenable. In it no allowance was made for the loss of iron from the body of the chalk by crystallization, nor for the segregation of the silica into flints. The absence of Globigerina and almost all the cretaceous fossils from the decomposed coral mud of Oahu, shows that they were not deposited under the same conditions. It is also argued that oceanic islands could not have received their peculiar land-shells by an oceanic route.——Mr. H. H. Howorth continues his voluminous argument upon the "Traces of a Great Post-glacial Flood."——C. Lapworth writes upon the identification of certain beds near Birmingham, England, hitherto supposed to be Upper Silurian, with the Cambrian era.——W. Dames gives some new facts upon the skull of *Archæopteryx*. The opening called nasal, by Marsh, is preceded by a third opening, entirely surrounded by the premaxillary, and this opening is affirmed to be the true nasal aperture. The clearing away of the matrix from the skull examined (that in the Royal Mineralogical Museum of Prussia) showed the dentition, and proved that Marsh was in error in considering that the teeth were limited to the premaxillary, as they occur at least upon the anterior portion of the maxillary. Mr. Dames also states that appearances are in favor of a separate alveolus for each tooth, rather than of a groove, as stated by Marsh. The shoulder-girdle is not yet cleared from the matrix, but appears to be different from anything known elsewhere. At a late meeting of the Geological Society of London Dr. R. Häusler communicated the results of his researches on the arenaceous foraminifera of the upper Jura of the Aargau—about sixty species are determined.——Mr. J. E. Taylor gives proofs of the occurrence, along the shores of Norfolk and Suffolk, of an extensive sub-marine peat-bed, full of bones and teeth of elephant,

ox, deer, etc. This part was nine feet thick in the course of the new channel cut for the Orwell river. Fishermen frequently bring up lumps of peat. Trunks of trees stand at Helm Searf, Norfolk. This confirms the theory of the marshy conditions prevalent previous to the submergence that converted Britain into an island. ——Professor T. R. Jones, in the fifteenth of a series of articles upon the Palæozoic bivalved Entomostraca, in the *Annals and Magazine of Natural History*, describes a carboniferous *Primitia*. In the same magazine (Sept. 1882), Dr. J. C. Hinde describes several fossil Calcispongiæ.

MINERALOGY.[1]

ANALYSES OF SOME VIRGINIA MINERALS.—Professor J. W. Mallet has communicated to the *Chemical News* some notes of work done by students at the University of Virginia upon American minerals.

W. T. Page has analyzed an allanite of unusual chemical composition from Bedford county, Va. It occurred as a compact black mass, with pitch-like luster, spec. grav. 4.32, and the unusual hardness of nearly 7. Its composition is as follows:

SiO_2	Al_2O_3	Ce_2O_3	Di_2O_3	La_2O_3	Fe_2O_3	FeO	MnO
26.70	6.34	33.76	16.34	1.03	3.21	4.76	trace

BeO	MgO	CaO	Na_2O	K_2O	H_2O
0.52	0.54	2.80	0.49	0.55	1.99

The very large proportion of the cerium metals present (over 50 per cent., or double the usual amount), and the large excess of didymium over lanthanum are peculiarities which may justify its being considered as a new variety of allanite.

B. E. Sloan has reëxamined the helvite of Amelia C. H., Va., already refered to in the NATURALIST. Having at his command a larger amount of pure material than Mr. Haines possessed, a new analysis was made which conforms more closely to the formula adopted by Rammelsberg. The analysis gave:

SiO_2	BeO	MnO	FeO	Al_2O_3	Mn	S	
31.42	10.97	40.56	2.99	0.36	8.59	4.9	= 99.88.

W. H. Seaman analyzed a pale hyacinth-red garnet from the same locality, which, like the other recorded analyses of the same variety of garnet—spessartite, or aluminum-manganese garnet, shows an anomalous deficiency of triad as compared with dyad metals.

R. N. Musgrave has analyzed the albite from the same locality, the analysis closely corresponding to the tri-silicate formula $Na\ Al\ Si_3\ O_8$. The albite here occurs as a delicately aggregated mass of colorless flattened crystals, forming beautiful specimens.

A supposed metallic meteorite from Augusta county—a pear-

[1] Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

shaped mass of iron covered with an oxidized crust—was examined by the same analyst found to be of terrestrial and artificial origin.

On the other hand, some rough, flattened scales of iron, with jagged edges and often twisted as though made by a lathe, which were found in the sand accompanying native gold in the bed of Brush creek, Montgomery county, and which W. T. Page has analyzed, are regarded as specimens of native iron. The largest grains weighed as much as 60–80 milligrammes, while the smallest were almost dust. Analysis showed traces of copper, sulphur and quartz. The scales were but slightly oxidized. The method of occurrence rendered it improbable that these scales could have been detached from the picks and shovels used at the washings.

ANALYSES OF SOME NORTH CAROLINA MINERALS.—In the same laboratory several North Carolina minerals have been examined.

W. T. Page examined the auriferous sand from Burke county, N. C., and found in addition to zircon, monazite, magnetite, etc., a number of malleable metallic grains, which, like those of the Virginia sand, referred to above, were often irregular, twisted and jagged. They were almost pure iron, mere traces of cobalt and quartz being present. The extended distribution of native terrestrial iron, thus shown, is of great interest.

Mr. Seaman has analyzed fergusonite from Brindletown, Burke county. It occurs in small reddish-brown crystals of tetragonal habit, and was first noticed by Mr. W. E. Hidden. Some four per cent. of tantalic acid was shown to accompany the columbium, the presence of didymium and lanthanum also being proved. Metals of the yttrium group, but of higher atomic weight (erbium, ytterbium, etc.) occur in small proportion with the yttrium. Counting the water as basic the ortho-columbate formula is deduced: $M'''\ Nb\ O_4$.

Mr. Seaman has also analyzed a columbate from the Wiseman mica mine of Mitchell county, which had formerly been regarded as euxenite, but which is shown to agree neither in physical characters nor in chemical composition with that species. The substance is compact, reddish-brown in color, with luster between resinous and adamantine, and with pale yellowish-brown streak. Hardness = 5.5. Spec. grav. = 4.33. The analysis gave

Cb_2O_5	WO_3 SnO_2	UO_2	Y_2O_3	Ce_2O_3	Di_2O_3 La_2O_3	FeO
47.09	0.40	15.15	13.46	1.40	4.00	7.09

CaO	H_2O	
1.53	9.55	= 99.67.

Unlike euxenite, no titanium is present, and the deduced formula is that of an ortho-columbate, $M''_3\ Cb_2\ O_8$, while euxenite is a meta-columbate. The percentage of water, the low specific gravity and the appearance of the mineral, with its external crust of

yellowish material which sometimes penetrates the interior, indicate that it is a product of the alteration of samarskite or some allied species.

At the same locality a mineral allied to allanite occurs as flattened crystals of pitch-black color, brownish-gray streak and with an imperfect conchoidal fracture. H. = 6. Sp. gr. = 3.15. Analysis gave:

SiO_2	Al_2O_3	Y_2O_3	Ce_2O_3	Fe_2O_3	FeO	MgO	CaO	H_2O	
39.03	14.33	8.20	1.53	7.10	5.22	4.29	17.47	2.78	= 99.95

In the very small percentage of cerium it contrasts strikingly with the mineral from Bedford county, Va., of which the analysis is given above. The different proportions of the other constituents also point to the mineral as a distinct variety of allanite.

A NEW VARIETY OF BOURNONITE. — A specimen resembling "Fahlerz," found at the Great Eastern mine, Park county, Colorado, has been analyzed by W. T. Page. The mineral was steel-gray in color, with metallic luster and dark-red streak, with a crystalline structure and brittle, uneven fracture, having a hardness of about 4, and specific gravity of 4.89. It fuses and gives antimonal fumes before the blowpipe. Analysis gave:

S	Sb	Cu	Zn	Fe	Pb	siliceous residue	
26.88	34 47	23.20	7.14	1.38	1.19	5.86	= 100.12

The copper exists one-half as cuprous and one-half as cupric sulphide. It is as distinct a species as stylotypite, but in order to avoid multiplication of names it is suggested that both stylotypite and the species here described be considered as varieties of bournonite.

NATIVE GOLD ALLOYS.—Mr. W. H. Seaman has examined a number of grains, which, picked out by the aid of a lens from the platinum grains of Colombia, S. A., are shown to consist of gold alloyed in different proportions with silver, copper or mercury. A gold-copper alloy contained nearly sixteen per cent. of copper, while an alloy of gold, silver and mercury contained eighty-four per cent. of gold and seven per cent. of each of the two latter metals.

Another alloy obtained from Taguaril, Brazil, contained eight per cent. of palladium, and corresponded with the formula, $Pd\ Au_6$. The palladium gave it a bronze-like color.

SOME GREENLAND MINERALS.—In a paper on some minerals from the sodalite-syenite of South Greenland, Mr. Joh. Lorenzen gives a number of analyses of interest. Among the substances analyzed were microcline, arfvedsonite, ægirite, nephelite, eudialite, lievrite and lepidolite. It is interesting to observe that most of these substances occur similarly associated in Southern Norway. The rock, composed principally of microcline, arfvedsonite and sodalite has frequently a reddish-brown color, due to an ad-

mixture of garnet-colored eudialite. The lepidolite was shown to have a composition differing from that usually ascribed to that species in having a larger percentage of silica, less than half the quantity of alumina, and unusually large quantities of alkalies and of water, while no fluorine was present. It is fusible in a candle-flame. This may be a new species of the mica group.

Another mineral of interest occurs in curved, irregular crystals in the same rock. It has a hardness of 4, specific gravity 3.38, and has a brown color and white streak. It fuses readily before the blowpipe to a gray, dull bead.

The following composition was obtained:

SiO_2	TaO_2	Fe_2O_3	Al_2O_3	ThO	MnO	CeO	LaO DiO
27.95	0.97	9.71	2.41	7.09	4.20	10.66	17.04
CaO	Na_2O	H_2O					
3.09	7.98	7.28 = 98.38					

The substance appearing to be a new species, the author has named it *Steenstrupine*, after Mr. Steenstrup, the discoverer of the mineral.

TIN IN ALABAMA.—It is reported that valuable loads of tin-bearing rocks have been discovered at the Broad Arrow mines, near Ashland, Clay county, Alabama. The tin occurs as cassiterite finely disseminated in gneiss. The ore is being crushed and reduced to the metallic state on the spot, works having been erected for the purpose. A bar of tin thus made has already been received in New York.

TELLURIFEROUS COPPER.—Professor T. Egleston, of N. Y., has reported to the American Institute of Mining Engineers an interesting case of the presence of tellurium in copper and of its effect upon the latter metal.

Some copper ore from Colorado had been sent to him to examine for arsenic and antimony. Finding neither metal present, a large quantity of the ore was purchased by a metallurgical firm, who, however, reported that they were unable to refine it, the furnaces having been "poisoned" by arsenic or antimony. Upon a re-examination of a larger quantity of material a trace of tellurium was discovered, the quantity being less than one-tenth of a per cent.

Although present in such minute quantity, the tellurium rendered the copper "red-shot." When the refined copper was passed through the rollers cracks showed themselves, which became larger the more the copper was rolled, until finally the cake of copper fell to pieces. When heated repeatedly the copper became covered with a white powder consisting of oxide of tellurium. No amount of heating could remove the tellurium or improve the quality of the copper. The influence of such a minute quantity of tellurium upon the copper is surprising.

BOTANY.[1]

NEW SPECIES OF NORTH AMERICAN FUNGI.—*Lophiostoma minus.*—Erumpent, conic, 1/3 mm in diameter and in height, ostiolum narrow and not very distinctly prominent; asci subcylindrical, 50–60 × 7μ; paraphyses linear, abundant; sporidia uniseriate or crowded above, oblong-elliptical, 3 septate with occasionally a partial longitudinal-septum, greenish brown, 9–13 × 5–7μ, sometimes with a short obtuse cylindrical appendage below. On dead limbs of *Nyssa multiflora.* Newfield, N. J., April, '82.

Diaporthe densissima.—Perithecia minute (1/4 mm) black, buried in the substance of the inner bark, mostly in groups of 15–30, their short subulate ostiola slightly converging but not united and barely penetrating the pallid, loosened epidermis which soon disappears around them, so that the bark of the affected shoots appears thickly dotted with little circular openings; asci clavate-cylindrical, 40–45 × 5–6μ; sporidia biseriate, fusiform, at first 4-nucleate, the endochrome is soon once and at length 3 times divided, 11–15 × 1½–2μ. There is the appearance of a faint, bristle-like appendage at each end of the young spore. On dead shoots of *Quercus coccinea.* Newfield, N. J., May, 1882. The upper part of the dead shoots, for a foot or more, is entirely occupied by the fungus, which is definitely limited, but scarcely marked on the border by any black circumscribing line.

Diaporthe Conradii.—Perithecia scattered, minute, depressed spherical, barely covered by the epidermis, not penetrating the wood nor circumscribed by any black line; ostiolum cylindrical, straight, rough, black, abruptly pointed above; asci subcylindrical, 35–40 × 6–7 μ; sporidia biseriate, ovate-elliptical, uniseptate, hyaline, scarcely constricted, 6-8 × 2½–3μ. On dead stems and branches of *Corema Conradii.* Willow Grove, N. J., May, 1882.

Valsa (Diaporthe) punctostoma.—Stroma cortical, formed of the unaltered substance of the inner bark, perithecia 8–12, 1/2 mm diam. in a single layer, their short cylindrical beaks joined in a small (3/4 mm) olivaceous slightly elevated disk, which is closely girt by the epidermis and pierced around its circumference by the black, obtuse, slightly prominent, rather broadly perforated ostiola; asci clavate-cylindrical, 55 × 8–9 μ; sporidia biseriate, oblong-elliptical, 4-nucleate, slightly constricted around the middle, hyaline, 11–13 × 4–4½μ. On dead limbs of *Amelanchier Canadensis.* Decorah, Iowa, July, 1882. E. W. Holway. No. 185.

Leptosphæria Xerophylli.—Perithecia scattered, subglobose, 150–190μ diam., sunk about half way into the substance of the leaf; ostiolum, obtuse, with a rather large opening, elevating and splitting the cuticle by which it remains partly covered; asci oblong or oblong-clavate, sessile, 55–60 × 15μ; paraphyses, indistinct; sporidia biseriate, broad, fusiform, slightly curved, hyaline

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

at first with 4 large nuclei becoming, 3 septate and slightly constricted at the septa, 19–25 × 5–6½μ (and brown)? On dead leaves of *Xerophyllum asphodeloides*. Willow Grove, N. J., May, 1882. Accompanied by *Hendersonia Xerophylli* Ell. (Bull. Torr. Bot. Club, vol. 9, p. 74), and by a *Pestalozzia*. On the same leaves are also minute superficial perithecia, containing oblong-elliptical brownish spores (4 × 2μ).

Leptosphæria stereicola.—Perithecia erumpent, hemispheric, black, rough, $\frac{1}{9}$ mm diam.; ostiolum acutely papilliform; asci, subcylindrical, 57 × 7½–8μ (paraphyses)? Sporidia biseriate, oblong-fusiform, 3-septate, brownish, 11–13 × 3–3½μ. On hymenium of *Stereum bicolor* Pers. Decorah, Iowa, July, 1882. E. W. Holway. No. 142.

Sphæria (Didymosphæria) cupula.—Perithecia membranaceous, scattered, convex-hemispheric when fresh, collapsed when dry; covered by the blackened epidermis, except the papillate ostiolum $\frac{3}{4}$ mm diam.); asci 75 × 7μ; sporidia elliptical, brown, uniseptate and uniseriate, 9½–11½ × 4½–5½μ. *Sphæria diplospora* Cke. has the same fruit, but the perithecia do not collapse.

Sphæria (Physalospora) Arthuriana, Sacc (in literis).—Perithecia amphigenous, erumpent, hemispheric ($\frac{1}{6}$ mm diam.), black, rough: ostiolum papilliform, with a rather large opening; asci clavate-cylindrical, 55 × 8μ; sporidia elliptical, granular, yellowish, slightly constricted around the middle, 11–13 × 7–9μ. On faded, yellowish indeterminate spots. On living leaves of *Iva xanthifolia*. Charles City, Iowa, August, 1882. J. C. Arthur.

Sphærella juniperina.—Perithecia at first covered by the epidermis, but soon bare, scattered or oftener subconfluent in the direction of the longitudinal axis of the leaf, so as to appear hysteriiform; asci fasciculate, 35–40 × 7–8μ; sporidia crowded or biseriate clavate-oblong granular (uniseptate)? subhyaline, 9–11 × 3½μ. The perithecia are minute and conic-globose. On fading leaves of *Juniperus communis*. Decorah, Iowa, May, 1882. E. W. Holway.

Sphærella Ilicis.—Amphigenous, on roundish spots (¼–½ cent. diam.) white above and brown below, with a distinct, slightly raised, dark purplish border, the purple color more distinct on the under surface of the leaf, Perithecia mostly in the central portion of the spots, punctiform, subglobose, the upper half projecting, about $\frac{1}{12}$ mm diam. and with a rather large opening; asci oblong-cylindrical, 40–55 × 7½–11 μ; sporidia biseriate, clavate-oblong, subhyaline, uniseptate and slightly constricted at the septum, 13–15 × 3 μ. On living leaves of *Ilex glabra*, Newfield, N. J., June, 1882. Differs from *S. Gaultheriæ* C. and E. in its rather smaller more symmetrically shaped perithecia, not concentrically arranged, and its rather smaller sporidia.

Sphærella Muhlenbergiæ.—Perithecia erumpent, minute, mostly in elongated series; asci oblong, 35 × 9½μ; sporidia elliptical,

uniseptate, 11–15 × 3-3½ μ. Stylospores in larger perithecia, oblong-fusiform, 15–19 × 4 μ, mostly 2 nucleate. On leaves of *Muhlenbergia*, cut about ten days ago and left lying on the ground. Newfield, N. J., July, 1882. The *Sphærella* made its appearance and came to maturity after the grass was cut. Possibly this is not sufficiently distinct from *S. graminicola* Fckl.

Gnomonia clavulata.—Perithecia membranaceous, globose, $\frac{1}{9}$–$\frac{1}{6}$ mm. diam, rough, bedded in the substance of the leaf, their bases projecting on the lower surface and their cylindrical, obtuse subclavate ostiola about equal in length to the diameter of the perithecia, projecting from the upper surface; asci oblong cylindrical, sporebearing part, 35–40 × 5–6 μ; paraphyses none; sporidia biseriate, oblong-fusiform, acute and 4 nucleate at first, becoming unequally uniseptate and obtuse, 7½–9 × 2 μ, yellowish. The tips of the ostiola are generally abruptly enlarged into a knob-like swelling, and are somewhat cup-shaped with a rather large opening. On fallen leaves of Quercus (nigra)? Newfield, N. J., May, 1882.

Gnomonia Magnoliæ.—Perithecia rather large, buried in the parenchyma of the leaf, the short, rufous, subulate-conic ostiola alone visible; asci oblong-elliptical, 40 + 7–8 μ, sporidia fusiform, acute, pale straw color, obscurely nucleate, 11–19 × 2 μ. On fallen leaves of *Magnolia glauca.* Newfield, N. J., July, 1882.

Ceratostoma subulatum.—Perithecia subulate, ½ mm high, apex subfimbriate and slightly enlarged; asci elliptical, 15 × 11 μ, sporidia subcubical, very light brown, 5–5½ × 3–3½ μ. On dead stems of *Œnothera biennis.* Newfield, N. J., July, 1882. Differs from *C. graphioides* Sacc. in its perithecia scarcely enlarged at base and in its paler, rather smaller sporidia. *C. caulicola* Fckl. also has rather smaller spores and perithecia enlarged below.

Ceratostoma albocoronatum.—Perithecia conic, minute, vomiting forth the ascigerous nucleus in the form of a white globule; asci cylindrical, 35 × 7 μ; sporidia uniseriate or partly biseriate, elliptical, hyaline, 1–2 nucleate, 7½–9½ × 3–3½ μ. Accompanied by obovate, brown, 2–3 septate, 11½ × 7½ μ conidia borne singly on the apices of erect brown, simple threads thickly scattered over the matrix. On rotton wood. Newfield, N. J., June, 1882.

Asterina capnoides.—Epiphyllous; perithecia minute ($\frac{1}{20}$–$\frac{1}{15}$ mm) seated on the toruloid mycelium which overspreads and blackens the leaf like a *Capnodium*; asci oblong, sessile, 30–40 × 11–13 μ; paraphyses none; sporidia biseriate, oblong-elliptical, uniseptate, constricted, obtuse broader at one end, hyaline, each cell with a single nucleus, 15–17 × 6–7 μ. The mycelium easily breaks up into elliptical, uniseptate brown (conidia)? resembling the spores of a *Diplodia.* On the same leaf was also a *Macrosporium* with 3 septate submuriform, pedicellate spores about 35 × 15 μ. On a living leaf of *Asclepias cornuti.* Charles City, Iowa, Sept., 1882. J. C. Arthur.

Asterina Xerophylli.—Perithecia on a scanty mycelium, entirely superficial, orbicular or subelongated, slightly depressed in the center, $\frac{1mm}{6}$ diam. asci obovate, contracted into a thick stipe-like base, 35 × 15 μ, sporidia hyaline, fusiform or clavate fusiform, faintly 3 septate, 18–20 × 3–3½ μ. On fading leaves of *Xerophyllum asphodeloides.* Willow Grove, N. J., May, 1882.

Asterina Ilicis.—Perithecia superficial, flat, punctiform, minute, mycelium nearly obsolete; asci globose-ovate, 22 × 15 μ; sporidia oblong, uniseptate, yellowish, 11 × 4 μ. On living leaves of *Ilex glabra.* Newfield, N. J, June, 1882.—*J. B. Ellis, Newfield, N. J.*

New Species of Micrococcus (Bacteria.)—*Micrococcus amylivorus.* Cells oval, single or united in pairs, rarely in fours, never in elongated chains, imbedded in an abundant mucilage which is very soluble in water; movements oscillatory; length of a separate cell .00004 to .000056 in.; width, .000028 in.; length of a pair, .00008 in.; of four united, about .00012 in.

In the tissues of plants causing the so-called "fire blight" of the pear tree and similar phenomena in many other plants. Through the action of the organism the stored starch is destroyed by fermentation, and carbonic acid, butyric acid and hydrogen is given off (American Association for the Advancement of Science, 1880; Tenth Report Illinois Industrial University, 1880).

This species was at first referred to the genus Bacterium, but this came from too exclusive attention having been given to its shape. It is only found in the tissues of affected plants or oozing from their cells and smearing the surface. It may, however, be cultivated in pure starch in water maintained at the temperature of ordinary summer weather. No doubt other nutritive ingredients would make the culture easier and more prompt.

M. toxicatus.—Cells globular, single and in pairs, rarely in chains of several articles; .00002 in. in diameter, movement oscillatory only.

In species of Rhus, and believed to be the peculiar "poison" for which these plants are noted. They may be found in the interior tissues of the stem as well as upon the leaves. Transferred to the human skin they multiply rapidly in number and penetrating the epidermis, through the sweat ducts (?) set up the inflammation so well known. If again transferred to healthy skin the same phenomenon follows. (American Association for the Advancement of Science, 1882; *American Monthly Microscopic Journal,* Nov. 1882).

M. insectorum.—Cell obtusely oval, isolated or in pairs, rarely in chains of several articles; .000022 in. wide and .000027 to .000040 in. long (usually about .000032 in. long); movements oscillatory only; forming zoogloœa (?).

In the digestive organs of chinch bugs *(Blissus leucopterus).* Discovered by Professor S. A. Forbes (American Naturalist, Oct., 1882). I have myself, in common with many others, ob-

served that these insects sometimes die off in great numbers during apparently favorable weather in summer. Sometimes indeed *all* infesting a given area seem to perish, so that the following season a collector can scarcely find one for his cabinet where there have been millions of them to the acre twelve months before. There is every appearance of a contagious disease by which they are thus swept away, and it is quite probable that the organism herein named is the true element of the contagion. It does, however, appear to be less virulent in its usual effects. It may be cultivated in meat broth.

M. gallicidus.—Cells globular, single or united in pairs; .00002 to .000029 in. in diameter; movements oscillatory only.

In the blood of the domestic fowl suffering with "chicken cholera."

While all who have studied this disease agree that the contagious element consists of minute, globular granules, capable of self-multiplication, it appears no one has named the organism nor given a description of it as a species. Dr. Salmon (Report U. S. Department of Agriculture, 1880) is inclined to attribute the origin of the granules to the direct transformation of the animal protoplasm. Readily cultivated in broth of chicken muscle.

M. suis—Cells globular, or elongated and more or less contracted in the middle, single and in pairs, rarely in chains of many articles; .000028 to .000032 in. in diameter (Detmers).

In the blood and other fluids of pigs, sick with swine plague or "hog cholera," described by Dr. H. J. Detmers (Report U. S. Department of Agriculture, 1878), under the name of *Bacillus suis.* The author, however soon after, recognizing more clearly the generic characteristics of these minute organisms, disclaimed the propriety of the classification first adopted by him. Careful studies have also been made in this country by Drs. Law and Salmon, but no name has been heretofore formally proposed except as stated. My own studies upon the organism, as such, accord with the descriptions published by the authors named and with those of Méguin of France.—*T. J. Burrill, Champaign, Ill.*

ENTOMOLOGY.[1]

INSTINCT OF THE SEVENTEEN-YEAR CICADA (CICADA SEPTENDECIM).—Talking to an observant neighbor of mine a few days ago, I learned the following facts which I thought worth sending to the NATURALIST. This neighbor informed me that his father cleared a piece of ground many years ago and left one oak tree standing about the middle of it. Twenty years or more passed by and the stumps had almost disappeared; when needing some especially tough wood he cut down this oak tree very near the ground in order to get as much of the butt as possible. Coming

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., may be sent.

home one evening he took his path across this clearing where the June grass then stood knee-high, and while passing the stump of the oak tree he was astonished to find the whole place alive with some insect which, on examination, proved to be the seventeen-year Cicada. They were well down among the roots of the grass, but what struck him as very singular was the fact that in all this host the head of every one was directed toward the stump which not one of them could see or ever had seen. Returning next morning to see what had become of them he found the stump literally buried with the cast skins of, as he expressed it, "millions of locusts." His explanation of their enormous number was that at their last appearance, finding the trees cleared away under which their larval stage had been passed, they had congregated on this one surviving oak and laid their eggs about it in great quantities. But how shall the strange fact be explained that after seventeen years' interment, every insect on emergence headed straight for the tree among whose roots it had been feeding? We say it is instinct that drives the Norwegian lemmings to "go west" periodically in millions, until they are drowned in the idle attempt to swim across the Atlantic. Was it also instinct that impelled these seventeen-year Cicadas towards the invisible trunk of the tree under which they had made for so many years their subterranean home? Did the "sense of direction" lie dormant in that mite of a nervous chord through its egg-existence, and for seventeen years afterwards? I know this phenomenon is not without parallel. The young of the canker worm do the same on emergence, and would probably do it if the tree had been cut down during the winter. But they are annual insects, and climb the tree for food and the reproduction of the species. In the case given the larva had been seventeen years out of sight, and yet makes straight on emergence for the stump of a tree which it could not see. It is, therefore, in all probability not aided by the sense of smell, or that other sense, if such it be, that is supposed to reside in the antennæ of insects.

The faculty that carries the lemming to destruction, and the Cicada towards the stump of its ancestral tree, does not deserve the name of reason, because it disregards changed conditions, but it seems a more wonderful faculty, at least, in some of its aspects. That the infinitesimal mite of matter composing the nervous system of this insect is susceptible to outside impressions, to retain them and transmit them for the use of generations yet unborn, for their guidance; is as wonderful as any act of reason, if not more so. The young insect may be said to see with its parents' eyes, and consequently sees things as they were in its parents' lifetime. Are the impressions made upon the nerves of the parent handed down to the offspring, as some of the physical or chemical properties of the proteine compound which forms the basis of their life?

In connection with the above narrative I should like to ask if larvae of the seventeen-year Cicada living on the roots of a tree, would be destroyed by cutting down the tree and killing its roots, especially during the earlier stages of their existence.—*E. W. Claypole.*

[The facts narrated are not so wonderful as they at first appear. The trees generally having been felled only a few years prior to the previous appearance of the Cicadas, seventeen years before, these, doubtless, came out all over the piece of cleared ground, and congregated on the isolated tree that had been left, filling its branches with eggs which supplied the ground beneath the tree with an unusual quantity of young Cicadas. This isolated tree was also cut down after the new generation had nearly acquired full growth. These insects had, doubtless, during the later years of growth fed on the roots of said tree, always with the head toward the butt, or in the direction of the increasing size of the roots. They had, probably, for nearly seventeen years been directed to the same point which they made for upon issuing from the ground as pupæ. This is one explanation of the facts, though we fully recognize that there is much to us inexplicable about the sense of direction in insects. Dr. H. A. Hagen recently mentions (*Nature*, Dec. 21, 1882) a singular case of the pupa of *Ophiogomphus* making direct tracks over the sand from the water, whence it issued to a solitary willow tree 100 feet away. We believe that the destruction of the roots of the tree would prove fatal to the Cicada larvæ except where it occurred after they had reached within two or three years of their full growth.—*C. V. R.*]

Food-habits of Megilla maculata.—In his investigations on the food of Carabidæ and Coccinellidæ, Professor S. A. Forbes records his observations, among others, on the above-named species, of which he dissected fourteen specimens. In eleven specimens, collected at various times around Normal, Ill., the food proved to consist of 46 per cent. of animal food (chiefly *Aphides*), and 34 per cent. of vegetable food, consisting of about equal proportions of pollen and spores of lichens. Three other specimens, collected in a corn-field, swarming with Chinch-bugs, had eaten only 13 per cent. of animal food (all insects, but no Chinch bugs among them), the rest being vegetable food and almost exclusively spores of fungi.

While these investigations tend to show that our Megilla is more phytophagous than entomophagous, at least in certain localities, yet the fact of its food consisting of fungi and pollen does not renders the species injurious to agriculture. What we stated on this last subject in the Naturalist for April, 1881, p. 326, rested solely on a communication from one of our correspondents, Mr. George B. P. Taylor, of St. Inigoes, Md. Our efforts to verify Mr. Taylor's statement by experiments in vivaria gave negative results, the beetles refusing to eat tender leaves of corn, grape-

vine, melon, morning-glory and clover. From these experiments and from Professor Forbes's investigations, we might feel inclined to doubt the correctness of Mr. Taylor's statement were it not for some field observations made last year by Mr. Theodore Pergande which tend to confirm those made by Mr. Taylor.

Mr. Pergande, while searching for injurious insects on corn in the vicinity of Washington, on August 22d, saw several imagos and larvæ of this species, actually eating into the soft kernels of the ears. The beetles were almost entirely within the nearly empty kernels, and it could plainly be observed that they were eating. Upon removing them the most careful examination failed to discover any other insect in the kernel. The larvæ were found in similar situations actively engaged in eating the substance of the soft seeds.

Clothes Moths Observed in the United States.—There has always been confusion and uncertainty in referring to the correct names of the clothes moths found in this country, and we are glad to note the fact that Professor C. H. Fernald, in the *Canadian Entomologist* for September, 1882, pp. 166–169, has given us a concise account of our species based upon a large collection brought together from all parts of the country and sent to Lord Walsingham for comparison with European species. It appears that we have no native clothes moths, the three species observed in this country being identical with European species. They are as follows: 1st. *Tinea pellionella* Linn., the case-making and most destructive species; 2nd., *Tinea tapetzella* L.; the gallery-making species, rare in this country; 3rd., *Tinea biselliella* Hummel, which is also not a case-making species. The intricate synonymy of the first and third species which have been redescribed by American authors under several names is given in full by Professor Fernald who also describes the imagos and gives some biological notes on the species.

Lepidopterous Larvæ and Yellow Flowers.—The larvæ of *Heliothis armigera* seems to have a partiality for yellow flowers. I found some feeding on the flowers of the evening primrose at Biarritz in October, last year; failing that, they readily took to honeysuckle flowers. When I brought them to England and offered them a choice of chrysanthemums (the only flower I had at the time), they preferred the yellow ones, and throve upon them. One day I gave them a red chrysanthemum, and they would not eat that, but ate one of their number; they had shown no tendency to cannibalism on the journey when the honeysuckle was not fresh.—*M. S. Jenkyns, in the Entomologist (London), January, 1883 (vol. xvi., p. 23).*

Note on Mutilla *(occidentalis* L.*)*.—From early boyhood I have occasionally seen this insect, but perhaps in all—in over fifty years—not more than fifteen or twenty of those of large size. They are known as "cow-killers" or "cow-stingers," and in

children excite more or less fear. I have often wondered why they were called "cow-killers;" having till the past summer never heard of any animal or person being injured by them. A cow, however, eating grass, and with the nose pressing one of them would probably be stung very severely. The sting, long, black and sharp, can be protruded almost the length of the whole body. Last summer I met with two persons who had been stung by the Mutilla—one, a negro man, who was stung when a cow-boy in Virginia; the other, now owner of Ballew's Creek Mills, in Forsyth Co., when a boy was riding under a dogwood bush, and knocked off one which fell into his shoe. The pain from the sting was great, the foot swelled, and he was lamed for a few days; but in neither of the cases were the symptoms alarming.

This insect is remarkably tough—difficult to kill. Unless the ground is very hard, it may be trodden upon with the boot, and rubbed and scrubbed into the earth, and yet when the foot is removed it will work itself out and run off apparently unhurt. Its whole envelope has the toughness of leather. The specimens sent are evidently larger than the *M. europœa.—Nereus Mendenhall, M. D., Westminster, Guilford Co., N. C.*

ZOÖLOGY.

TRANSACTIONS OF THE LINNÆAN SOCIETY OF NEW YORK.—This Society, which has been in existence for several years, issued in December, 1882, its first volume of Transactions in royal octavo form of 168 pages, and is unexceptionable as regards paper and presswork. The spirit of the papers making up the text is excellent, as they are based on extensive and painstaking field work. The first article is the longest, it is devoted to a fresh and valuable account of the mammals of the Adirondack region, a work which we have noticed in another place. The second article, by Mr. Wm. Dutcher, is entitled "Is not the fish crow (*Corvus ossifragus* Wilson) a winter as well as a summer resident at the northern limit of its range?" He answers the question in the affirmative, the evidence tending strongly to show that the bird is a permanent winter resident in its northern habitat, instead of a rare summer visitor. The third and last article is "A review of the summer birds of a part of the Catskill mountains, with prefatory remarks on the faunal and floral features of the region." By E. P. Bicknell. Some of the mammals and all the batrachians and reptiles noticed in the Catskills are enumerated. The author does not accept the claim that two efts, *Diemyctylus miniatus* and *viridescens* are identical, as claimed by a writer in this journal (xii, 399). The paper is an interesting and comprehensive sketch of the natural history of a beautiful mountain region.

REMARKS ON THE DISTRIBUTION OF MARGARITANA MARGARITIFERA (LINN).—Already much has been said in the pages of the NATURALIST in regard to this species, yet a fuller exposé of its east-

ern distribution may not be without interest. Mighels in his Catalogue of the Shells of Maine (Boston Jour. Nat. Hist., vol. IV., p. 325, 1843), says: "This species is plentiful all over the State. * * * It occurs plentifully at Cape Elizabeth, near the sea" "Specimens from different localities differ much among themselves, being more or less curved, or elongated, and some are perfectly straight, differing in no respect from *U. sinuosa* and *elongata* of Lamarck, from Germany and France. With Mr. Lea I believe them identical." E. S. Morse, in his "Observations on the Terrestrial Pulmonifera of Maine" (Journ. Portland, Soc. Nat. Hist., 1864, pp. 47 and 52), refers to the species as common and "found in great numbers in several rocky, muddy brooks, near Portland. Have rarely found it in the interior." The species is by no means rare in Massachusetts. It occurs in Charles river, at Newton, Mass., the shells are here well developed; at Lunenburg the shell is found in small brooks and the specimens are diminutive in size, scarcely attaining a length of 2½ inches; it is also found at Leominster, an adjoining town, and under similar conditions. At the village of Haydenville, a part of Williamsburg, in Hampshire county, it is found in the greatest abundance, very perfect, and of large size, in the tributaries of Mill river; it is doubtless found in the streams of Worcester county, in the central portion of the State. Gould, in his "Invertebrata of the State" (both editions, 1841 and 1870), gives it as found in many of the streams of the State, but not near the seaboard. Dr. James Lewis, in his "Shells of New York," includes it by name only, giving no localities, he not having had access to De Kay's "Mollusca of New York," while making his list. De Kay gives it as "one of the largest and most common Unios," and as "from Rockland county, Champlain, Oneida and many other localities." J. F. Whiteaves in his paper "On the Land and Fresh Water Mollusca of Lower Canada" (p. 17), says: "Very large and fine in St. Charles river, near Quebec; J. F. W. Green and Rimouski rivers; both of the Matapedia lakes; Lake St. John, R. B." In his "Mollusca of Nova Scotia, 1877," J. Matthew Jones says: "Fresh water lakes and streams." During a visit to the southwestern portion of Nova Scotia in 1879, by the writer, while making an examination of the lakes and water-power of Yarmouth and the lower portion of Digby counties, he observed large numbers of Unios and Anodontas in the region, but failed to discover *M. margaritifera*.

In the spring of 1882 specimens were received from Professor A. Hyatt, of Boston, for identification; they were collected by him at the Island of Anticosti, in Fox river, during the summer of 1881. Professor Hyatt had previously visited the island in company with Professors Shaler and Verrill, in 1861, and made large collections for the Agassiz Museum, at Cambridge, and though the fresh waters of the islands were then diligently

searched no Unionidæ were found. It is not improbable that the *Margaritana margaritifera* made its advent during that interval; its occurrence upon this sea-girt and isolated island, separated from the main land by at least twenty miles of open water, is an interesting fact, and presents a problem in the distribution of fresh-water shells, which only the methods of Darwin can surmount. The occurrence of the form *falcata* of Gould in the waters of Oregon, the occurrence in the streams emptying into Columbia, and into Puget sound, as recorded by Cooper; the localities recorded by Carpenter, east of the Rocky mountains; and the known high range of the species in Europe, make its occurrence in the intermediate portions of the British possessions not improbable, and I confidently look for it in these waters, when they are more fully examined.—*A. F. Gray.*

THE SYSTEMATIC POSITION OF THE ARCHIPOLYPODA, A GROUP OF FOSSIL MYRIOPODS.—Mr. S. H. Scudder early last year published in the Memoirs of the Boston Society of Natural History an elaborate paper, with four excellent plates, entitled "Archipolypoda, a subordinal type of spined Myriapods from the Carboniferous Formation." The author has been fortunate in obtaining valuable material for this work, and has with great evident pains and throughness worked out the characters of these Myriopods, the remains of which belong to four genera and twelve species. He regards the Myriopods as an "order," and the Chilopoda and Diplopoda as "suborders," and proposes for the group of Carboniferous Myriopods under consideration the term *Archipolypoda*, considering them as constituting a group equivalent in rank to the Diplopods (or Chilognaths).

The *Archipolypoda* are thus characterized; "Palæozoic Myriapods, with a fusiform body, largest near the middle of the anterior half or third, the head appendages borne upon a single segment; each segment behind the head composed of a single dorsal and two ventral plates, the dorsal of nearly uniform length superiorly and inferiorly, occupying most of the sides as well as the top of the body; destitute of foramina repugnatoria, and divided into ridged anterior and flat posterior portion, the anterior provided with longitudinal rows of spines or tubercles; the ventral plates occupying the entire ventral portion, each having a pair of long jointed legs, and furnished outside of them with large spiracles, the mouth transversely disposed."

Having been recently studying the Lysiopetalidæ, a rather aberrant and synthetic family of Chilognaths, we have, after reading Mr. Scudder's memoir in order to ascertain their relation to his Archipolypoda, felt obliged to dissent from some of his conclusions, though not doubting the evident accuracy and clearness of his descriptions of the remains upon which his genera and species are based.

The above quoted definition will apply in some points to the

Lysiopetalidæ and the characters are those, it appears to us, which indicate a group of Chilognaths (Diplopoda), standing below but equivalent in rank, perhaps, to the existing forms taken together. In his comparisons with the Chilognaths, the author seems to have had the Julidæ in view, and not to have mentioned the Polydesmidæ or Lysiopetalidæ; for some of these and other Chilognaths have a "fusiform body." That the "head appendages" are borne upon "a simple segment" is an assertion which Mr. Scudder's figures do not apparently indicate. The head is swollen on the sides, and is much wider than the three succeeding body-segments, which are narrower than those behind (pl. 13, fig. 16), as in the Lysiopetalidæ. Only the antennæ are figured and nothing is said of the mouth parts. From the author's figures we seem justified, from the general shape of the head, in supposing that Euphorberia and its allies resembled other Chilognaths in having a pair of mandibles and a labium or under lip. This implies, of course, that like all Chilognaths the head is composed of three segments. The presence or absence of repugnatorial pores is not important. We have been unable to find them in Lysiopetalidæ, though they may exist, as these Myriopods are well known to secrete an abundant malodorous fluid. The "long jointed legs" are little if any longer than in the Lysiopetalidæ, where the legs are remarkably long as compared with the Julidæ. In the Lysiopetalidæ the anterior part of the segments is swollen anteriorly and bears tubercles ending in setæ, while the posterior portion is flat. The characters "destitute of foramina repugnatoria, and divided into a ridged anterior and flat posterior portion, the anterior provided with longitudinal rows of spines or tubercles," will apply to the Lysiopetalidæ as well as to the group under consideration. The nature of the spines of the Archipolypoda forms a remarkable feature. They are often large, stiff and spined in certain genera—in one genus (Eilecticus) they form simple warts. The singular spinulate spines give an *outré*, bizarre appearance to these fossils; but an approach to them, we think (contrary to the author's opinion, see p. 144, foot note 3) is seen in the barbed setæ on the segments of the embryo Strongylosoma. The author does not refer to the spinulose or barbed setæ so abundant on the little living *Polyxenus fasciculatus*, also a Chilognath, which though more numerous and minute are apparently homologous with those of Euphorberia, etc.

Spined setæ of Polyxenus.
A. M. Edwards del.

The antennæ are not referred to in the diagnosis of the suborder, but in his comparisons the author only refers to the typical

Chilognaths, *i e.* the Julidæ. They appear, in reality, in length to be intermediate between those of the Julidæ and Lysiopetalidæ; the terminal joint is long and free, and seem, as seen in Pl. 13, figs. 7 and 18 to be 7-jointed as in all Chilognaths, the terminal or seventh joint being rather long and slender, as in the Lysiopetalidæ.

The most striking character of the Archipolypoda appears to be the presence of a large spiracle on *each* segment instead of alternate segments, as in Chilognaths and Chilopoda. In position the spiracles are as in other Myriopods.[1] Another important features is the great development of the sterna, which are broad, so that the insertion of the legs are wide apart; the scuta do not of course descend so far down on the sides as in the Julidæ; but an approach to the form of a section of the body, is seen in the Polydesmidæ, and particularly in Polyxenus; in this genus, as in the Archipolypoda, the sternites or "ventral plates" also "occupying the entire ventral portion." With the exception of the fact that the spiracles are apparently developed upon *each* segment instead of alternate, we do not find in the author's diagnosis any good reason for establishing a suborder equivalent to the Chilognaths.

They appear to us to constitute a group nearly equivalent to the Lysiopetalidæ, but standing below them. We would agree with Mr. Scudder that the Archipolypoda are an ancient type and the precursors of the modern Chilognaths. This is suggested by the retention and enlargement of the spiny setæ which occur in embryo and larval Chilognaths, and the presence of a pair of spiracles on each segment. In Hexapoda each segment behind the head in the embryo bears a pair of spiracles, and when as much is known of the development of Myriopods as of that of Hexapods and Arachnids, this may be the case with Myriopods. The essential characters of the Chilognaths are that all the postcephalic segments behind the three first, bear each two pairs of legs.[2] The Archipolypoda do not differ from them in this respect. Another essential feature is that they possess one pair of mouth-appendages less than the Chilopods; and from the form of the head, the eyes, the antennæ and especially the swollen genæ of Scudder's figs. 16, 18, pl. 13, which recalls the peculiarity in the Lysiopetalidæ, we have good reason for inferring that the Archipolypoda had a pair of mandibles and a pair of maxillæ, *i.e.*, an under lip.

The legs of some of the Archipolypoda appear to be "compressed and slightly expanded, strengthened also on the flattened surface by longitudinal ridges, and have in every respect the aspect

[1] In Polyxenus, however, there are, according to Bode, two minute pairs to each segment (see his Vol. XIV, fig. 14).

[2] It should, however, be borne in mind that Pauropus is partly, and Eurypauropus almost wholly diplopodous. We are almost inclined to regard them as degenerate Chilognaths, but at present should retain them as types of a distinct order; they are however much more aberrant forms than the Archipolypoda.

of *swimming legs* in those specimens in which the appearance of the legs is most clear." In some of the figures the legs appear to be much in form and length as in the Lysiopetalidæ. In speaking of the legs, Mr. Scudder seems to have in mind only the even-jointed legs of the Julidæ; but those of the Lysiopetalidæ resemble the legs of the Archipolypoda in having the joints very uneven; the third joint being about one-third as long as the entire leg. Moreover, the legs of certain existing Myriopods are, if we mistake not, more or less flattened. Besides the second pair of legs in Sphæropœus, which are flattened, adapting them for clasping; those of certain Ceylonese Julidæ, figured by Humbert (pl. IV., fig. 19*h* and 21*g*), have broad expansions on some of the joints, though the legs end in claws. The legs of Euphorberia and all the other Archipolypoda end, apparently, in sharp points, and this indicates that they must have had sharp claws. We do not see that the form of the feet indicates aquatic habits; had they been adapted for swimming we should have expected that their form would have been more or less spatulate and without claws.

A singular feature of the Archipolypoda are "peculiar organs, situated one on either side of the median line, at the very front edge of the ventral plate; to these it seems to be impossible to assign any other function than that of support for branchiæ; they consist of little tringular cups or craters, projecting from the under surface, through which I believe the branchial appendages protruded; so far as I am aware, no other organs than branchiæ have been found in any Arthropoda situated within the legs, and repeated in segment after segment." These structures are certainly remarkable, and suggestive of branchial supports, and it is to be hoped that fossils will be discovered, with remains of the branchiæ themselves. Whether an aquatic, swimming branchiate Myriopod would have such large spiræles may be questioned. But at any rate the Archipolypoda are a most interesting group, whatever be our views as to their position and nature; they may be regarded as larval forms, and in some degree as synthetic forms, with no modern representatives. Still, we should not exclude the type from the Chilognaths, though, perhaps, forming a suborder of the Chilognaths, assuming that the Myriopods should rank as subclass. Thus the order of Chilognaths might be divided into two suborders, the lower and more larval and extinct group being the Archipolypoda, and the higher the genuine Chilognaths. In this connection it may be observed that the embryo Chilognaths have at first but a single pair of legs to each segment; in subsequent stages new segments are added, from each of which two pairs of legs arise. The possession of two pairs of legs, then, is a secondary and acquired character. We have a parallel to it in a family of Phyllopod Crustacea, the Apodidæ, in which from two to six pairs of legs in post-larval life arise from a single segment.—*A. S. Packard, Jr.*

THE VOGMAR OR VAAGMÆR (TRACHYPTERUS ARCTICUS) AND THE KING OF THE HERRINGS (GYMNETRUS BANKSII.)—Dr. Lütken has recently published some valuable additions to our knowledge of these two deep sea fishes, based upon material that has accumulated in the museum of Copenhagen.

Thirteen examples, varying from 830 to 2200^{mm} (about 2 ft. 9 in. to 7 ft. 4 in.), of the former fish gave sufficient material to enable Dr. Lütken to decide that, spite of great variations in the proportional length of the head, height of the body, size of the eyes, profile of head, number of rays in dorsal and caudal, position of the lateral line, and position of the anus, which exceptionally is in advance of the middle of the length, there is but one valid species of Trachypterus in the northern seas.

After the study of this northern form, the author unhesitatingly declares his conviction that all the "species" described from the Mediterranean belong also to one species (*T. iris*) which can, however, be distinguished from *T. arcticus* by its longer and more gradually tapering tail and less elevated body. Rudiments of ventral fins, consisting of a broken prismatic exterior ray and remains of five other rays, were found in two examples; and the smallest of the series had distinct remnants of the five separate anterior dorsal rays, which in all the others were broken down to stumps hidden beneath the skin. Dr. Lütken believes that this loss of the nuchal and ventral fins is natural rather than accidental, especially as the dorsal fin itself is usually well preserved. The number of dorsal rays varies from 154 to 186 (without the nuchal rays), they are rough in the young, but in adults smooth, except for the basal spine. The length of the fin-rays generally is greatest in the young, and the spines of the lateral line, the last nine to fourteen of which are large and sharp, are in the young distinct to the origin of the lateral line.

The King of the Herrings is a much rarer fish, so rare that only thirty are on record from the coasts of Norway and England during 140 years. The Copenhagen museum possesses an example 12½ feet long from the Faroe islands. This was much broken, but was supplemented by a drawing executed before the animal was damaged. The anus is situated scarcely five feet from the front of the head, the greatest height is one foot, and the ventral fins are represented by two elongated, almost vitreous rays of rhomboidal section and three and three-quarters feet in length. The dorsal fin of this individual had 256 rays, besides eleven or more rays in two elongated nuchal fins. The long ventral rays end in a membranous expansion. From the accounts given of *Regaleus* (=*Gymnetrus*) *Grilli* (18 feet in length and with 400 dorsal rays), and of *R. glesne* (10½ feet long and with only 168 dorsal rays), and of other examples of fishes of this genus, Dr. Lütken concludes that the former is but an unusually large state of *R. banksii*, while the latter is at best an uncertain species. During the growth of the

fish the tail appears to lengthen and increase in number of rays, while the relative height of the body and length of the head diminishes in proportion to the total length.

The dimensions of this fish are in Danish feet. Curiously Trachypterus, though found upon the coast of Norway, Ireland, Faroe and Iceland, has not yet occurred upon that of North America.

The principal distinctions between the two genera are the prolongation almost to the extremity of the tail, of the cul-de-sac of the stomach; and the greater feebleness of the skeleton and greater elongation of the vertebræ in Regalecus. In both genera there are about 100 vertebræ. The vogmar has no ribs, while the eighth to the twenty-fourth vertebræ of the King of the Herrings have true ribs.

Notes on Floridian and Texan Fishes.—During a short stay at Pensacola and Galveston Prof. Jordan collected 129 species of marine fishes, of which sixteen were previously undescribed.

There are apparently seven species of Carcharias in the waters of the Atlantic and Gulf coasts, including one which may prove to be new. The cyprinodonts taken were nine in number, including two new Funduli. The Spariodæ are represented by ten species, among which is the red snapper or Pargo colorado (*Lutjanus blacfordi*) the most important food-fish of the Gulf coast. This is taken with hook and lines on the "Snapper Banks," some five to thirty miles off shore. It reaches a weight of about 35 pounds. *Mullus barbatus*, the famous European surmullet, was represented by a specimen taken from the stomach of the red snapper. This is the first authentic record of the occurrence of this species on our coast.

Among the new species were a Prionotus (*P. scitulus*), *Porichthys plectrodon*, a Gobiesox (*G. virgatulus*), four blennioids, and two flat fishes of the genus Paralichthys.

Shufeldt's Contributions to the Anatomy of Birds.—Little, except the papers by Dr. Coues on the osteology of the loon, and of J. A. Jeffries on the fingers of birds (*Nuttall Bulletin*) had been done in this country in the osteology of our native birds before Dr. Shufeldt began his series of papers in the Bulletin of Hayden's Survey, and in the pages of this journal. The present work occupies from page 593 to 786 of the Twelfth Annual Report of the U. S. Geological and Geographical Survey, F. V. Hayden U. S. Geologist-in-Charge, and has been published (Oct. 14th, 1882) in advance of the report itself. Dr. Shufeldt's work beginning with an account of the osteology of the burrowing owl (*Speotyto cunicularia hypogæa*), next treats of the osteology of *Eremophila alpestris*, with abundant illustrations. These and the next chapter are revisions of papers previously published in the Bulletin of the Survey. Of a more elaborate character is the chapter on the osteology of the Tetraonidæ, as here we are treated

to new matter on the habits and distribution of some of the western members of this family. In this, as in former monographs, the author omits any detailed description of the osseous elements of the ear, or the respiratory tube, small sesamoids, or such tendons as may ossify in the extremities. It would be impossible, even if we had the requisite knowledge, to make any abstract of this interesting comparative sketch of a group belonging to the Gallinaceous birds, concerning whose osteology so much has been written. We pause to notice that Dr. Shufeldt applies the name *pentosteon* to what in the first edition of this monograph he called the pisiform bone, and which is the fifth bonelet in the avian wrist. The chapter on the skeleton of the Lanius or shrike is succeeded by an interesting comparative essay on that of the vultures. The publication of these papers should exert a most healthy influence on the scientific study of the birds of this country, as the tendency is in systematic ornithology too much towards a reliance on superficial, external characters.

A White Raven.—A milk white raven, with pale pink eyes and red legs, is now being exhibited in the Berlin Aquarium, to the material augmentation of that admirable institution's daily receipts. It received admission to the great central aviary in which scores of beautiful birds flutter and chirp and build their nests in comparative freedom, but his presence there spread such general panic among the remaining inmates of the *voliere* that it has been found necessary to remove him to a separate cage. Strange as it may seem, the other birds instinctively recognized that this corvine albino was abnormal, and therefore terrible. Many of them became total abstainers from food and drink through sheer fright while he shared their quarters, and huddled together, shivering, at as great a distance from the fearful anomaly as the limits of their prison would permit them to attain. In all respects, save its extraordinary hues, the raven is as other ravens. His appetite is apparently insatiable, and he ministers to it with a formidable beak. Neither in tone nor delivery is there any unusual mellowness or tenderness about his croak. His pink eyes could not be more steadfastly engaged in contemplating the main chance were they as yellow as burnished gold. He was found with a coal-black brood of brothers and sisters, in a nest built by his parents —whose surprise at his peculiar appearance must, we should think, have been considerable—on the topmost branch of an old tree in the Georgenthal, a valley of Thuringen. Doubly an anachronism, this snow-white raven is at present one of the "lions" of the German capital.—*Forest and Stream.*

The Anatomy of the Chiroptera.—M. A. Robin has recently devoted much study to the anatomy of those parts of the bats which are not employed in locomotion, and which have been neglected by most naturalists, who have mainly devoted them-

selves to the skeleton and muscular system. The examination of one or more genera of all the important types proves the Chiroptera to be a very homogeneous group, one of the most homogeneous of the mammalian orders. The genus Harpyia links together the two suborders usually admitted, since its skeleton is that of a roussette, and its viscera those of a bat. The digestive apparatus varies in accordance with the habits of the sections of the order, but these variations are only those which are physiologically necessary, such as differences in the shape of the teeth, the capacity of the stomach, the length of the intestine, and the development of the glands. Apart from variations in relation to alimentation, the stomach is constructed according to two types, simple and compound. The pancreas is compact in the rousettes, diffused in ordinary bats. Among the constant characters of the digestive system are the presence of peculiar tridentate tooth-like processes (*odontoides*) near the tip of the tongue, and the very general existence of two entirely distinct pairs of sub-maxillary glands. The relations of the glottis with the palate are similar to those found in the horse and the elephant, and enable the bats to keep the mouth open while flying without deranging respiration. The larynx is simple and normal, but in some forms vocal boxes (*caisses*) are formed by the modification of the superior tracheal rings. There are considerable variations in the structure of the accessory glands of the male genital apparatus. All the forms of uterus known among mammals can be found in this order. In some species the uterus is a single vessel like that of the highest primates; but more generally it is bicornate, with very various degrees of development of the horns with respect to the body. Others have two distinct uteri placed side by side for a portion of their length, so as to look like a two-horned uterus, and again, others have two completely separate uteri, opening separately into the vagina. The variability of this organ in an order so homogeneous as this is of a nature to show that too much importance has been attached to its coalescence or separateness in classification, and this is strengthened by the fact that, since M. Robin published his first researches, Mr. Watson has shown that the Indian elephant has not only two distinct uteri, but two distinct vaginæ also. M. Robin has proved that the umbilical vesicle, though attached to the chorion during all foetal life takes no part in its vascularization, which is entirely of allantoid origin. Thus all the embryogenital characters show their relation to the primates.—*Condensed from Revue Scientifique, 22 Apr., 1882.*

Zoölogical Notes.—*Archiv für Naturgeschichte* Jahrg. 49, Heft. 1 (dated 1883, but received in November or December, 1882), contains a lengthy article by Dr. C. Bülow on division and regeneration in the worms (*Lumbriculus variegatus* Gr.). Bonnet cut a Lumbriculus into twenty-six pieces, several of which became complete animals. Of a Lumbriculus which Bülow cut into four-

teen pieces, only one piece died, the rest developed a head and tail. Worms which had been operated upon occurred with two very well formed tails.——Dr. Bertkau in the same *Archiv* describes a case of sexual dimorphism in the Psocidæ.——The beginning of an important paper by Dr. Bedriagra, on the Amphibians and reptiles of Corsica also appears in this heft of the *Archiv.* The three plates representing the anatomy and osteology as well as the sexual apparatus, and the mode of sexual congress of a Corsican salamander are useful.——The hibernation of the jumping mouse has been described by C. J. Maynard in the Quarterly Journal of the Boston Zoölogical Society, Jan. 1883. "It enters the ground before the frosts set in, and makes a burrow from five to seven feet in depth, usually in sandy soil. At the end of this burrow it constructs a nest of dried grass, in the middle of which it lies curled up, in an unconscious state. Those which he removed, appeared as if dead, except that they were limp. The peculiar stupor they exhibited is their normal state during the winter. No food is ever found in the nest or burrow.——Mr. J. A. Allen recorded in the third volume (p. 645), of the NATURALIST, that the swallow-tailed hawk was seen at Wately, Mass. Mr. A. P. Chadbourne records in the above journal, the fact that this bird was shot in Amesbury, Mass., Sept. 25.——In a communication to the *Scientific American*, Mr. Robertson states that bees do not injure grapes or other fruits that are in a healthy condition; but will suck at them the moment a wound has been made by birds or other insects, or by putrefaction. This he has proved by placing bunches of grapes close to a hive. No bee touched them until he punctured half of the grapes, when they at once attacked the punctured grapes.——M. Giard has discovered in the sands of the Glenans islands (Finisterre, France), an annelid which links the Lycoridæ to the Hesionidæ and Polynoë on the one side, and the Syllidæ on the other.——In the October issue of the *Am. Jour. of Science*, Mr. J. F. Whiteaves notices the discovery, by Mr. J. Richardson, then of the Geological Survey of Canada, of a recent polyzoon which cannot be distinguished by any tangible character from the Japanese and New Zealand species of Heteropora described by Messrs. Waters and Busk. The Japanese form was described in 1879 as *H. pelliculata*, and was the first recent example of a genus before supposed to be Mesozoic and Tertiary.——Mr. F. A. Lucas, in Ward's Nat. Sci. Bulletin, notices and figures some singular osteological abnormalities, such as the skull of a fowl, the frontal region of which is immensely developed; a seventh cervical vertebra of a pig, provided with a rib; a human foot and hand with the fifth digit duplicated; and some biped cats, with atrophied pelvis. These cats climbed and walked on their front legs, carrying the body almost perpendicularly. He also figures a deer's head with a third antler growing from a separate pedicel.——In the *Monatsbericht, K. Akad. Wiss.*

Berlin, Professor Peters describes a new species of his Chiropteran genus Mormopterus, from Amboina, and gives a synopsis of the five species comprised in that genus. The same naturalist describes in the *Sitz. Gesellschaft. Natur. Freunde*, four species of fishes and four of snakes, the latter including two of Typhlops from Africa, and two of Elaps from Ecuador; gives a review of the species of the families Typhlopidæ and Stenostomidæ; a description of a new Tachydromus from Amurland; a list of the seven Scincoids and Geckoes found by Herr Finsch in the Marshall, Carolina, and Gilbert groups (probably introduced from ships); a note upon the excrescences developed during the breeding season on the male of *Rana gigas*, an East Indian (Sikkim) species; and a description of two new species of snakes of the genus Psammophis. Professor Peters also describes three Scincoids, one from New Guinea, and two from South Australia, a Callophis from the Phillipines, and several annelids from various quarters. He also notices an example of the remarkable genus Potamogale from the interior of Angola. The insectivorous nature of the animal was fully proved by the contents of the stomach. In the same series of proceedings, Professor Von Martens describes several mollusks from the collection obtained by the corvette *Gazelle;* two Squillidæ, *Lysiosquilla polydactyla* from Chili, and *Gonodactylus trachurus* from the Mauritius, and some pulmonates from Central Asia; Herr Karsch describes several Coleoptera from the islands off the Guinea coast; Herr Hartmann gives some interesting particulars relative to the pectoral-muscles of certain fishes, especially those of a Periopthalmus from Madagascar, and Herr K. Brandt writes upon the mutual life of animals and algæ, describing certain genera and species of unicellular algæ which inhabit protozoa, sponges, hydrozoa, actinozoa, and turbellaria, and are the source of the chlorophyll found in those animals.——In the Bulletin of the Buffalo Society of Natural Sciences is a description of a new Tortricid, by C. H. Fernald, and notes upon the Spongillæ, by H. Mills. Mr. Mills adds to Mr. Potts' genus Carterella, so well characterized by the tendril-like prolongations of its statoblasts, a new species, *C. tubisperma.*——W. A. Forbes, Prosector to the Zool. Society of London, has examined the structure of the palate in several trogons, and finds that the maxillopalatines neither unite with each other, nor with any median ossification, so that the Trogonidæ are not desmognathous, but schizognathus. As their nearest allies, the Bucconidæ, Galbulidæ, Coraciidæ, Podargus, etc., are desmognathous, Mr. Forbes believes that the importance of the palate in classification has been overestimated. Careful observations conducted upon an incubating *Python molurus* in the Zoölogical Gardens of London prove that the temperature of the female rises, on an average, 3° F. above the normal temperature—an increase nearly identical with that which results in cases of fever.

PHYSIOLOGY.[1]

THE SIXTH SENSE.—At a recent meeting of the Anthropological Institute, London, Mr. Francis Galton, F. R. S., exhibited and explained some apparatus contrived by himself, with a view of testing the muscular and other senses. This apparatus consisted of a box, something like a backgammon board, containing trays of weights arranged for measuring the relative delicacy of the muscular sense (the sixth added by modern psychological science to the five recognized by the ancients) as existing in different persons.

The principle Mr. Galton claimed as a new one. It established, he said, a graded scale of sensitivity, and was applicable, by means of analogous methods, to testing the delicacy of other senses, such as taste and smell. He employed small weights arranged in sequence, which were numbered in succession 1, 2, 3, etc., and differed by equally perceptible variations, as calculated by Weber's law. Hence if a person, A, could just distinguish, say, 1 and 3, he could also distinguish between any two weights two grades apart, as 2 and 4, 3 and 5, etc. Again, if another person, B, were twice as obtuse as A, he would be able to distinguish one grade only where A could distinguish two. In other words, he would be only just able to distinguish between weights 1 and 5, 2 and 6, and so on.

Generally, the number of grades between the weights that any person could distinguish had to be found by trials, and that number became the measure of the coarseness of his sensitivity. The weights used were blank cartridges, filled with shot and wadding, care being taken that the shot should be equally distributed. They were arranged in trays, each tray holding a sequence of three. The person tested had to arrange the cartridges in the tray handed to him in the true order of their weights.

Some provisional results of the plan were mentioned. One was that men had, on the whole, more delicacy of discrimination than women; another, that intellectually able men had more than other men. It further appeared that women sensitive to a morbid degree were not remarkable for their powers of discrimination. Sensation was produced in them by a feeble stimulus, and so was pain, but the intervening numbers of just perceptible differences did not appear in their case to be exceptionally large.

ATLAS OF EMBRYOLOGY.—The "Selections from Embryological Monographs," compiled by Messrs. Agassiz, Faxon and Mark, of the Museum of Comparative Zoölogy at Cambridge, will form an invaluable atlas of drawings selected from the best authorities. It will, when completed, be a most timely publication for students in the United States, and form an introduction to the literature of the subject, both bibliographical and pictorial. As stated by the

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

projector of the series, Mr. Agassiz, the curator of the museum, these selections "will give to the student, in an easily accessible form, a more or less complete iconography of the embryology of each important group of the animal kingdom. This selection is not intended to be a hand-book, but rather an atlas to accompany any general work on the subject."

The Crustacea appeared last year, the bibliography having been prepared, and the plates selected by Professor W. Faxon. The lithographic work is well done, and considerable new matter by both Mr. Agassiz and Professor Faxon has been added in the plates; the most noteworthy being the early stages of the hermit crabs, and the barnacles. The phenomena connected with the fecundation and maturation of the egg, and the history of the formation of the embryonic layers, will be treated of in a separate part. The parts devoted to Echinoderms, Acalephs, and Polyps are in an advanced stage of preparation. We have detected no omissions of importance in the part already issued.

A Myriopod which produces Prussic Acid.—In several of the hothouses in Holland, a Myriopod is frequently met with which (according to Herr Weber, of Utrecht), is a foreign species of the genus Fontaria, and has the remarkable property of producing prussic acid (HCy). Attention was called to this on finding that the animal, when excited, gave out a strong smell of oil of bitter almonds. The phenomenon is still more pronounced on bruising. Some specimens having been distilled with water, prussic acid was found in the distillate. Herr Egeling has lately made a series of experiments to test the view that this Myriopod prepares a substance which, under certain conditions, is decomposed, giving prussic acid as one of the products of decomposition. This was fully confirmed. By action of various reagents, a substance was detected, which is split up by water, yielding HCy. It further seemed probable that, besides this substance, the animals possess one which acts as a ferment, and which the author hopes to be able to separate.—*English Mechanic.*—[Note. The *Fontaria virginica*, a common Myriopod in Pennsylvania, has long been known to emit a powerful smell of Prussic acid.—E. D. Cope.]

The Tracheæ and the Source of Light in Fire-Flies.—*Nature* gives an abstract of Wielowiejski's account in the *Zeitschrift für Wissenschaftliche Zoölogie*, of the light-producing organs in *Lampyris splendidula* and *noctiluca*. He sums up the most important results as follows: 1. The "tracheal terminal cells" of Schultze, which become black under osmic acid, are by no means—as their name would imply—the terminations of the respiratory tubes; for these branch out further on into brush-like masses of much finer capillaries, which are without the chitinous spiral; they are very attenuated, and making their way in to the peritoneal layer, are numerously distributed to phosphorescent

tissue. 2. The tracheal capillaries very rarely end abruptly (blind) in the phosphorescent organs, but most frequently anastomose with one another, forming an irregular meshwork. 3. The capillaries do not seem to enter into the structure of the parenchymatous cells, but rather course along their surface, often irregularly winding around and enveloping these. 4. The tracheal terminal cells are nothing more than the outer elements of the peritoneal layer at the base of tracheal capillaries, which radiate in a brush-like fashion from a chitinous spiral trachea. 5. The tracheal terminal cells are not the seat or point of departure of the light development. If this appears first in their vicinity it is only a consequence of the fact that these structures have, owing to their affinity for oxygen, stored up in themselves a supply of this gas, and give it off in greater quantity to the neighboring tissues. 6. The light-producing function is peculiar to the parenchyma cells of the light-producing organs. It results from a slow oxydation of a substance formed by them under the control of the nervous system. 7. The ventral light-organ was found to consist of two layers, the parenchyma-cells of which are quite similar to one another in their morphological characters, but they differ from one another in the chemical nature of their contents. 8. The parenchymatous cells (is this the case with all ?) seem connected with fine nerve-endings. 9. The light-organs are the morphological equivalents of the fatty bodies.

PSYCHOLOGY.

DREAMS.—

"We are such stuff
As dreams are made on."—*The Tempest.*

Shakespeare's lines may serve as the expression of a curious and important psychological truth. We may truly and philosophically be said to think and perceive, and therefore to exist exactly as dreams are made. For the only existence which we know is that presented to us in consciousness according to certain laws which prescribe precisely how we are to be conscious, not only of the outside world which comes to consciousness through the senses, but also of the internal world of our own mind.

For example, it is impossible for the mind to think intelligibly anything entirely by itself independent of all cause or effect; it is impossible to think a sensation such as coolness or a color like blue by themselves without any substance which is cool or body that is blue.

It is to this law of thought that dreams owe their origin; and which in their turn they serve to illustrate and explain as in other mental phenomenon can.

Let us take for example one of the commonest classes of dreams. It is a warm night, and a man is sleeping at an open window. At first all the senses are unexcited, and he sleeps

dreamlessly. Now let a sudden strong wind spring up as sometimes happens; the air strikes the sleeper and chills him. The sensitive nerves of the skin are excited, and transmit their excitement to the sleeping brain where it appears as a sensation. But the rest of the brain is asleep, the nerves of hearing, of seeing, of smelling unexcited, give no sensations, and thus the brain has nothing given to it but this single sensation—coolness.

Observe what happens; a dream forms itself in the brain of the sleeper, which takes shape something like this. He is in a boat or a bridge or the shore of a stream, he is fishing, sailing, gunning, whatever has last occupied his mind, and will serve, and then by some logical chain of events, he finds himself plunged in the cold water. A shiver runs through him, and he awakes.

In this way the sensation of coolness which the nerves of the skin have transmitted to the brain is thought; that is to say the sensation of coolness having been forced into consciousness, and demanding to be thought some function of the mind has set to work to make the thinking of it possible, and has invented this little story of the sailing and the cold water for that purpose.

However long the story invented may apparently be, in reality the invention of it is as instantaneous as a flash of lightning, showing that the act of the mind is simply the effort to think the sensation presented to its consciousness, and is but a single act, not a continuous chain of acts.

There is a story told of a sleeper awakened by the violent slamming of a door. Between the hearing of the noise and his awaking, he dreamed he had entered the army, had been sent to war, had deserted, had been captured, and was about to be shot. The discharge of the guns that were to kill him, wakened him, and was the sound of the door that had actually been slammed. His dream had occupied the space of time between hearing the sound and his awakening.

Dreams, then, in their philosophical aspect may be defined as the attempt of the understanding[1] to think a sensation by placing it in connection with other sensations which it invents for the purpose when deprived by slumber of the aid of the other senses. In such a position the understanding unable to make a conception or picture—which is necessary for intelligent thought—out of a single sensation is compelled by the law of its operation to gather together sensations which it accordingly invents for itself in order that it may have sufficient material for a conception. These sensations, which it invents, are naturally those which are found usually in connection with the sensation it is engaged in trying to think.

Of course when the dreamer awakes, his understanding at once

[1] I have taken the liberty of using the terms employed by Kant in his Kritik of Pure Reason, the most perfect, as I believe it is the only complete treatise on these obscure but important processes of thought.

and almost mechanically sets to work to form a new conception out of the real sensations which are then presented to consciousness, and discards the old conception which it had made out of invented sensations.

The same process, only in a fainter and less noticeable way, takes place occasionally in our waking hours, when, for example, in hearing a sudden noise, we exclaim, "I cannot understand that!" For in such a case the understanding is left with only this one sensation out of which to make as conception. But being fully awake, the understanding of the man does not go on to invent sensations, but it waits and makes no attempt to think the noise until it receives sufficient real sensations out of which to make a conception.

As for example, the noise is heard as the man is walking in a forest, and not having sufficient sensations for a conception, he turns around and looks and sees a man with a gun smoking or a tree just fallen or a wagon, and thus having with his eyes added other sensations his understanding is enabled out of the material gathered to make an intelligent conception.—*T. B. Stork.*

Fritz Müller on the Inheritance of Traditions among Social Insects.—In a letter to *Nature*, Fritz Müller, referring to Mr. C. Lloyd Morgan's excellent paper on animal intelligence (*Nature*, vol. xxvi., p. 523), quotes from him as follows: "The brute has to be contented with the experience he inherits or individually acquires. Man, through language, spoken or written, profits by the experience of his fellows. Even the most savage tribe has traditions extending back to the father's father. May there not be, in social animals also, traditions from generation to generation, certain habits prevailing in certain communities in consequence neither of inherited instincts nor of individual experience, but simply because the young ones imitate what they see in their elder fellows?"

Müller then adds: "As is well known, the stingless honey-bees (Melipona and Trigona) build horizontal combs consisting of a single layer of cells, which, if there is plenty of space, are of rather regular shape, the peripheral cells being all at about the same distance from the first built central one. Now, on February 4, 1874, I met with a nest of a small Trigona (Abelha preguicosa) in a very narrow hole of an old canella-tree, where, from want of space they were obliged to give to their combs a very irregular shape, corresponding to the transverse section of the hole. These bees lived with me in a spacious box about a year (till Feb. 10, 1875), when, perhaps, not a single bee survived of those which had come from the canella-tree; but notwithstanding they yet continued to build irregular combs, while quite regular ones were built by several other communities of the same species, which I have had.

"The following case is still more striking. In the construction of the combs, for the raising of the young, as well as of the large cells for guarding honey and pollen, our Meliponæ and Trigonæ do not use pure wax, but mix it with various resinous and other substances, which give to this wax a peculiar color and smell. Now, I had brought home from two different and distant localities two communities of our most common Melipona (allied to *M. marginata*) of which one had dark reddish-brown, and the other pale yellowish-brown wax, they evidently employing resins from different trees. They lived with me for many years, and either continued, in their new home, to gather the same resins as before, though now, when they stood close together, any tree was equally accessible to the bees of either community. This can be hardly attributed to inherited instinct, as both belonged to the same species; nor to individual experience about the usefulness of the several resins (which seemed to serve equally well), but only, as far as I can judge, to tradition, each subsequent generation of young bees following the habits of their elder sisters."

ANTHROPOLOGY.[1]

LANGUAGES OF AFRICA.—In the Journal of the Royal Asiatic Society, Vol. XIV, p. 160 (April, 1882), Mr. R. N. Cust gives us a paper with the following title: "Notice of the scholars who have contributed to the extension of our knowledge of the languages of Africa."

The continent is thus divided:

North of the Equator. I. Semitic group.
II. Hamitic group.
III. Nuba-Fulah group.
IV. Negro group.

South of the Equator. V. Bantu.
VI. Hottentot-Bushman group.

I. SEMITIC GROUP = Ethiopic, Old Ethiopic or Geez, Amharic, Tigre and Harâri.

II. HAMITIC GROUP = Berber (Old Mauritanian or Numidian), Kabyle (Showiah and Zowiah dialects), Tuaricks, Zenágas (S. of Sahara), Suvah, and the Ethiopic sub-group of Somáli, Galla, Beja-Bishari, Falasha (Abyssinian Jews), Wogos, Dankali, Agau, Barea, Saho, Kunáma.

III. NUBA-FULA GROUP = Nubian sub-group of Nubian or Barabra, Tumale, Masai, Kwafi, Monbutto, and Niam-Niam, and the sub-group of Fulahs.

IV. NEGRO GROUP.—

A. *Western Negro-land*, Atlantic side, Senegambia and Guinea coast: Mandingo, Serawale, Vei, Susu, Mende, Wolof, Sereres, Bullom, Temne, Sherbro—Bullom, Hausa, Sourhai (Timbuctoo), Kru, Grebo, Basa, Gwe, Yoruba, Ashante, Fanti, Akra (Gá), Affetu.

B. *Central Negro-land*, Basins of the Niger and the Tchad, Ibo, Efik, Nupe, Kanuri (Bornu), Baghirmi, Budduma, Logone, Wandala, Maba, Sara, Badi Baele, Kuka-Lisi.

C. *Upper Nile Basin*: Dinka, Shilluk, Bari, Bongo.

[1]Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

V. BANTU GROUP.—

A. *Zulu-Kafir*: Kafir or Xosa, Zulu, Chuana, Suto.

B. *East Bantu*, E. coast, from Victoria Nyassa to 23½° S.: Swahili, Manganga, Makua, Yao, Nyassa, Makoude, Nyamwezi, Shambala, Gindo, Zaramo, Angazidja, Gogo, Boondei, Ruganda, Pokomo, Nika, Kamba, Chaga, Teita, Nyoro, Sena, Quilimane, Maravi, Inhanbane.

C. *West Bantu*, from Cameron mountains to Tropic of Capricorn: Kongoese, Bunda, Herero (Damara land), Loango, Kongo, Mpwongwe, Bakule, Benga, Dualla, Jsubu, Fernandian.

VI. HOTTENTOT-BUSHMAN GROUP.—

A. *Hottentot*. Namaqua only surviving dialect.

B. *Bushmen*, including Central African pigmies.

Of course, Mr. Cust does not propose this as an exhaustive classification of African tribes or languages. The title of the article is sufficiently definite. Each tribal name is accompanied with the name of the author who has compiled a vocabuarly, grammar or dictionary.

In a few months Mr. Cust will publish a language map of Africa with a bibliographical appendix showing where the language is spoken with reference to the map.

In the same number of the Journal is a discussion of the words Tartar and Tatar, with a decided leaning to the former.

ANTHROPOLOGY IN GREAT BRITAIN.—The November number of the Anthropological Institute Journal gives us the following original papers:

On the aboriginal inhabitants of the Andaman islands (Part II). By E. H. Man.

On the relation of Stone Circles to outlying stones or Tumili, or neighboring hills, with some inferences thereon. By A. L. Lewis.

The Papuans and the Polynesians. By C. Staniland Wake.

On some rites and customs of Old Japan. By C. Pfoundes.

English surnames from an ethnological point of view. By Dr. John Beddoe.

On the survival of certain racial features in the population of the British Isles. By J. Park Harrison.

Inverting the order, Mr. Harrison looks for the evidence of race survivals in a large collection of photographs collected by the anthropometric committee of the British Association, with which he has brought into comparison a large series of observations in the continental areas from which the English race is believed to have come.

Mr. Beddoe has collected the names of peers, baronets, magistrates, M. P's, F. R. S's, College of Physicians, University Club, mayors, Knights of Bath, sergeants-at-law, subscribers to books and pauper lists. From these he has deduced the per cents. of Normans, Saxons, local names, occupations, nicknames, patronymics, Welsh, Scotch, Irish and foreign names.

Mr. Pfoundes has succeeded in rescuing from oblivion some remarkable old legends and survivals in Japan.

The paper by Mr. Wake is an attack upon Mr. Keane's classification of the Papuans and Polynesians. Such nice criticisms

have just enough of plausibility in them to give them effectiveness. But surely half a loaf is better than no bread, and the best possible arrangement under the circumstances is infinitely better than hopeless confusion.

Of the archæological papers it is scarcely worth while to speak, further than to say that archæologists should always scrupulously mark the relation of permanent remains to their environment.

With Mr. Man's papers we are always delighted. He has such a happy way of laughing out of countenance the vagaries of scientific guesses. It is related of a certain celebrated American general, who was making the tour of the world, that he said the French found great difficulty in speaking their own language so as to be understood by Americans. Mr. Man finds the Andamanese profoundly ignorant of many of the most fascinating ideas and customs that have been attributed to them. Guess, gentle reader, who is to blame, the Andamese or the lunatics who have reported them.

THE ANTIQUITY OF MAN.—In the "Bibliotheque des Sciences Contemporaines" is to be found the matured thought of the greatest specialists in France. Already we have Biology, by Letourneau; Linguistique, by Hovelacque; Anthropologie, by Topinard; Sociology, by Letourneau; L'Espece Humaine, by De Quatrefages; and now Le Préhistorique Antiquité de l'homme, by Gabriel de Mortillet, professor of prehistoric anthropology in the School of Anthropology, Paris. The volume contains 642 pages 12mo, and has sixty four figures in the text. In a general sense, the work represents the views of the majority of working archæologists of France, and it will not be amiss, therefore, to give an epitome of its contents. The introductory portion is chiefly historical, and well done; the science is divided into three parts:

1. Tertiary man, or the origin of humanity.
2. Quaternary man, or the development of humanity.
3. L'homme actuel, first horizon, prolegomena of history proper.

The evidences and data of the first part are marks on bones, crushed bones, pierced and engraved bones, human remains, evidences of fire, flaked flint, with closing chapters on the fossil apes.

The second era is divided into different epochs, as follows: Chelléen, Moustérien, Solutréen and Magdalénien.

The third part, or era, is similarly treated as the Robenhausien epoch.

Each of these partitions of archæology is treated with the finesse of a skilled workman and the confidence of an adept. It is painfully true, however, that much hay, straw and stubble are built into this stately edifice that the fires of afterthought will burn out. Nevertheless, if we do not make first efforts and failures, we shall never progress to second efforts and success. The following table exhibiting the Tertiary and Quaternary superposition in the

scheme of M. de Mortillet will show how elaborately the subject has been treated in the work:

Upper.	Secondary.	India; silicified forests, with cuttings (Marchesetti).
Inferior Tertiary. Eocene.	Soissonien. Londonien. Parisien. Bartonien.	Lignite of Montaign, boule en Craie (Melleville).
	Ligurien.	Siderolite of Délémont; human skeleton (Quiquerez).
Oligocene.	Tongrien.	Fontainbleau sandstone; petrified man over his horse.
	Aquitanien.	Limestone of Beauce, Thenay; flaked and broken flint (Bourgeois).
Middle Tertiary. Miocene.	Mayencien.	Gravels of Orleans; marked bones (Nouel). Fresh-water formation of Gannat; gashed bones (Pomel). Fresh-water chalk of Billy; gashed bones (Laussedal). Sansan hill; broken bones (Garrigou). Marl of Anjou, Poreance; incised bones (Delaunay, Tournouër). Marl of Anjou, Chavagne-les-Eaux; incised bones (Farge).
	Helvetien.	Miocene of Dardanelles; chipped flint, scratched bones (Calvert). Mollasse of Central France; human skeleton (Garrigou).
	Tortonien.	Fossiliferous diggings of Pikermi; broken bones (De Ducker). Trachytic conglomerate of Cantel; chipped flint (Tardy, Rames).
		Miocene and Pliocene deposits of Portugal; chipped flint (Ribeire).
Upper Tertiary. Pliocene.	Astien.	Deposits of San Valentino; wrought bone (Ferretti). Ossiferous diggings of Val d'Arno; scratched bone (Desnoyers). Strata of San Giovanni; scratched bone (Ramorino). Deposits of balænotus at Monte-Aperto; scratched bones (Capellini). Blue marl of Savone; human bones (Issel). Piedmont; pierced scapula of mastodon (Gastaldi). Red crag of Suffolk; pierced sharks' teeth (Charlesworth).
	Saint Prestien.	Alluvium of California; implements (Blake), skull (Whitney). Autry Issard; silicified wood cut (Charnaux). Saint Prest.; scratched bones (Desnoyers), chipped flint (Bourgeois).
Quaternary.	Chelléen.	Alluvium; human bones and objects of industry.
	Moustérien.	" " " " "
	Solutréen.	Grottoes " " " "
	Magdalenien.	" " " " "

BIBLIOTHECA AMERICANA.—Robert Clarke & Co., Cincinnati, have issued a catalogue of books and pamphlets relating to America, containing 6589 titles, with prices. Many of these works are rare and some of them almost out of the market. A reprint of John Leith's travels and captivity among the Indians, covering a period of eighteen years (1774–1792), in a limited edition, is announced. The same firm advertises Shea's Mississippi series in three volumes, and Dr. Brinton's Library of Aboriginal American Literature, the first number of which is now ready.

MICROSCOPY.[1]

THE USE OF CHLOROFORM PREPARATORY TO IMBEDDING IN PARAFFINE.—As is well known to all who are familiar with the use of the microtome, objects to be imbedded in paraffine must be saturated with some solvent of paraffine. It has been found that the different solvents do not all give equally good results. The use of chloroform, which is now coming into general use, was first proposed by Dr. Giesbrecht,[2] of the Zoölogical Station at Naples; but was soon afterwards recommended by Professor Bütschli,[3] to whom the Journal of the Royal Mic. Society (Oct., 1882, p. 708) has inadvertently given the credit of the discovery. Chloroform is unquestionably superior, in certain important respects, to oil of cloves, creosote or turpentine. *It is particularly to be recommended where there is danger of shrinking and brittleness.* The method of using it has been briefly stated in the October number of this journal (p. 783).

In the *Zoologischer Anzeiger*, No. 129, p. 20, Professor Kossmann, of Heidelberg, says that chloroform is the only solvent that can be successfully used in the case of objects with thick chitinous membranes.

In the use of chloroform two points must be carefully attended to, namely, the *complete saturation* of the object before it is placed in paraffine, and the *complete evaporation* of the chloroform before the object is finally imbedded. If the first point is not secured, of course the paraffine will not penetrate the object thoroughly; and if the chloroform does not wholly escape before the process of imbedding begins, the paraffine will be spongy, and consequently unfit for section-cutting. The evaporation of the chloroform may be effected in two or more ways. In all cases the object must lie in chloroform until thoroughly saturated. Then paraffine may be added gradually, as recommended by Dr. Giesbrecht; or the saturated object may be placed in a solution of paraffine in chloroform, as recommended by Professor Bütschli. After remaining here until it is thoroughly impregnated (an hour or less), it may

[1] Edited by Dr. C. O. WHITMAN, Newton Highlands, Mass.

[2] Giesbrecht, "Zur Schneide-Technik." *Zool. Anzeiger*, 1881, No. 92.

[3] Bütschli. *Biol. Centralblatt*, vol. I, p. 591 (1881).

be placed in a watch-glass with a little of the solution, and kept at a temperature of about 50° C. until the chloroform has escaped. In case of larger objects they may be transferred directly from the solution to pure paraffine, without undergoing the slow process of evaporation.

Kossmann transfers the object directly from pure chloroform to pure paraffine, and allows it to remain in the paraffine (kept at a constant temperature of 50° C.) for several hours—sometimes for two or three days.

DR. SCHULGIN'S MIXTURE FOR IMBEDDING.[1]—Instead of pure paraffine, Dr. Schulgin uses a mixture of paraffine with ceresin, a substance somewhat similar to wax, but firmer and much less brittle. Paraffine which melts at 55° C. is recommended; and the amount of ceresin to be added to a given amount of paraffine may be determined by experiment. The finest sections of this substance are not brittle, and herein lies the chief excellence of the mixture. If this mixture proves too hard, it may be softened by adding a little vaseline.

EAU DE JAVELLE AS AN AGENT FOR REMOVING THE SOFT PARTS FROM MICROSCOPICAL PREPARATIONS.—Perls,[2] Altmann and Noll[3] recommend *Eau de Javelle* ($KClO_3$) as an excellent fluid for removing the soft parts of animal and vegetable tissues. If a piece of Spongilla, for example, is placed on a slide and a drop of this water added, all the soft parts are destroyed in 20–30 minutes, and the spicula are left *in situ*. After the protoplasmic parts have been thus removed, the preparation is carefully treated with acetic acid, in order to remove any cloudy precipitates; then washed with weak, strong and absolute alcohol successively; and finally mounted in oil of cloves and balsam.

Very neat preparations of diatoms may be obtained with this fluid. The calcareous part of shells thus treated is not destroyed. Sections of plant buds were successfully treated and then mounted in Meyer's fluid (10 volumes glycerine, 20 dist. water and 1 salicyl-methyl acetate).

The skeletons of small animals may be easily prepared by placing the bodies in Eau de Javelle, which removes the skin, muscles, &c., without injuring the bones.

——:o:——

SCIENTIFIC NEWS.

— The Balfour Memorial.—The form which the Balfour Memorial has taken makes it a subject of far more general interest than could have been the case had the testimonial been merely a personal tribute to the man, great as he was. An American com-

[1] *Zoologischer Anzeiger*, VI, No. 129, p. 21, 1883.
[2] Arch. f. microscop Anat., vol. XVI, 1879.
[3] *Zoolog. Anzeiger*, V, No. 122, p. 528.

mittee has been formed with the object of increasing the fund on this side of the water. Mr. Alexander Agassiz, of Harvard University, is chairman, and Professor H. N. Martin, of Johns Hopkins University, is secretary and treasurer of the committee, which is made up of scientific men representing widely separate regions. The following extracts from the statement of the secretary of the American committee, invoke the aid of every one to whom the advancement of biological knowledge is not a matter of indifference:

"The Balfour Memorial first took definite form at a public meeting held in the lecture-room of comparative anatomy in the University of Cambridge, England, on the 21st of last October.

"At this meeting it was determined to found a memorial to Professor Balfour, and that this memorial should take the form of a fund, to be called the Balfour fund, for the promotion of research in biology; especially animal morphology. It was further decided that the proceeds of the fund be applied:

"(1) *To establish a studentship, the holder of which shall devote himself to original research, especially in animal morphology.*

"(2) *To further, by occasional grants of money, original research in the same subject.*

* * * * * * * * * *

"(1) *That the value of the studentship be not less than £200 a year.*

"(2) *That while it is desirable that the studentship should be in some way closely connected with this university, persons other than members of this university shall be eligible to it.*

"(3) *That it shall not be given away by competitive examination.*

"(4) *That in framing regulations both for the conduct of the student and the award of occasional grants, the primary object of the fund, namely, the furtherance of original research, be closely adhered to.*

"It will be the aim of the trustees to select as Balfour student, not the man who shows best in answering examination papers, but in Dr. Michael Foster's words, to choose 'not necessarily the cleverest or the most brilliant man, but the man who in their judgment will best carry out the objects of the fund; that is to say, the man who seems most likely to devote himself with success to biological research.' The income exceeding £200 per annum derived from the endowment, will be utilized from time to time for such purposes as providing the Balfour student with expensive apparatus and specimens; in sending him to parts of the world especially fitted for his work; or in making grants for apparatus or material to others of limited income engaged on morphological research. The value to science of such a fund can hardly be overestimated; and the larger it is the greater will be its usefulness.

"At the Cambridge meeting referred to, subscriptions were promised sufficient to endow the Balfour studentship. All that is

in future contributed will go to increase the power to make additional grants for special researches. What the American committee hope for, is not to raise a large sum of money but to obtain some small contribution from the majority of American biologists, whether investigators, professors or students. Some subscription, however small, from the members of each college and university in the United States where biological studies are carried on, would be a far more pleasing tribute to Balfour's memory than larger gifts from fewer persons."

— The *Scientific American* quotes from the *Sun* an account of the occurrence of a Filaria in the eye of a horse in Jersey City. The writer of the article says, "I do not believe that this parasite is ever found in human beings." *Filaria oculi* is stated however in Moquin-Tandon's Medical Zoology to be not uncommon in the negroes on the Angola coast; "it is also met with at Guadeloupe; it has been seen by Mongin at Cayenne, and by Blot at Martinique." "The *Filaria oculi* resides in the lachyrmal gland and in the globe of the eye. In 1768, Bajou extracted one of these worms from the eye of a young negress about six or seven years of age. Dr. Guyon extracted another from the eye of a negress in Guiana. The worm is seen winding about and moving around the globe of the eye, in the cellular tissue which unites the conjunctiva with the sclerotic. Sometimes its presence does not occasion any disagreeable sensation (Bajou); while at other times it causes very acute pain (Mongin). Occasionally it is accompanied by a constant watering of the eye." The Filaria of the crystalline lens *(F. lentis)* Diesing is found in that part of the eye. M. Normann detected the Filariæ coiled up together, by means of the microscope, half an hour after the operation for cataract. Two similar cases occurred in Germany.

— In connection with the recent discussions on solar energy, it has been lately noted by M. Rey de Morande, in the Paris Academy, that fossil botany has given a new extension to Laplace's hypothesis of a gradual contraction of the sun. The extensive coal-beds found in polar regions appear to show that these latter, at one time, received nearly as much of the solar light and heat as equatorial regions. So long as the sun was of such a diameter as to heat and light the two poles, there was great uniformity in our planet's vegetation, but about the Cenomanian epoch (*i.e.*, middle Cretaceous) this state of thing ceases rather rapidly. Plants with caducous leaves appear first in northern regions, and gradually spread southwards, confining arborescent ferns and other primitive plants to an ever-narrowing equatorial zone. In the polar regions, moreover, vegetation disappears. These facts, according to the author (following Dr. Blandet), are explained by the gradual contraction of the sun, but remain inexplicable by the simple hypothesis of a gradual cooling of the earth.—*English Mechanic.*

— It appears by Gen. Sheridan's report to the War Department that the National Yellowstone park is rented out to private parties who are using it for money-making purposes. While it was the original intention to make it a game preserve, since its discovery as many as 4000 elk have been killed by "skin-hunters," 2000 having been destroyed last winter alone, together with deer, mountain-sheep, etc. Gen. Sheridan recommended, says the *Nation*, that the park be extended in an easterly direction about 40 miles, so as to add 3344 square miles to its area, and "make a preserve for the large game of the West now so rapidly decreasing."

— At a recent meeting of some members of the general committee of the British Association, says the *English Mechanic*, it was determined to memorialize the council with reference to the proposed visit to Canada. The question has been under consideration for some time; and it is probable that the meeting will be held as usual in this country for the transaction of formal business, and will then be adjourned to Montreal. A suggestion is, that the meeting should be held in England, and a deputation be sent to Canada—the deputation, presumably, including all who wish to go. See NATURALIST for 1882, page 896.

— The French Minister of Agriculture has lately placed at the disposal of M. Pasteur a new sum of 50,000 fr. ($10,000), in order to continue his admirable investigations upon the contagious diseases of animals. The government had already granted to the illustrious savant, for the same object, 50,000 fr. in 1880 and 40,000 in 1881. The minister consulted a special committee, who, in view of the brilliant success obtained by Pasteur in his previous investigations, unanimously recommended a renewal of the grant.—*Scientific American.*

— The Saturday lectures under the auspices of the Biological and the Anthropological Societies of Washington are in course of delivery in the lecture-room of the U. S. National Museum, Saturday afternoons. The programme for the first six lectures is as follows: Capt. Clarence E. Dutton, U.S.A., on rivers; Professor Otis T. Mason, on the races of men; Mr. George Kennan on mountains and mountaineers of the Caucasus; Dr. D. Webster Prentiss on mesmerism in animals (with experiments); Professor Theodore Gill on mythical animals; and Dr. John S. Billings, U.S.A., on germs and epidemics.

— The U. S. S. *Enterprise*, Commander A. S. Barker, sailed Dec. 27 for the Cape Verde islands and the China station via Cape Town. The *Enterprise* has the outfit necessary for a scientific cruise, and will take deep-sea soundings every hundred miles from the United States to Cape Town.

— Prof. von Bischoff, the distinguished biologist, died in Munich, Dec. 5. He was born at Hanover in 1807, and having studied medicine, he became a lecturer on pathological anatomy at Heidelberg, whence he migrated to Giessen as professor of physiology. He was, however, attracted in 1854 to Munich by the King of Bavaria, and remained until his death. He was the author of important memoirs on the development of the vertebrates, especially of the dog, guinea pig, and the roebuck.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BIOLOGICAL SOCIETY OF WASHINGTON, Jan. 19.—Professor Theo. Gill, the retiring president, delivered the retiring address entitled "The principles of zoo-geography." Communications were made by Dr. Elliott Coues on zoölogical nomenclature applied to histology; by Professor Otis T. Mason on the human fauna of the District of Columbia.

NEW YORK ACADEMY OF SCIENCES, Jan. 22.—The following papers were read: On the treatment of sea-sickness by the trance state, by Professor Edward P. Thwing; Notes on the botany, geology and resources of Southern Texas and Chihuahua, by Dr. John S. Newberry.

Jan. 29.—The following paper was presented: The decay of the building-stones of New York City (with lantern illustrations from American and foreign architecture), by Dr. Alexis A. Julien.

Feb. 5.—The following papers were read: On a large mass of Cretaceous amber, from the marl of Gloucester county, N. J., by Mr. George F. Kunz; Remarks concerning the recently discovered reticulated structure of living matter, and the "bioplasson doctrine," by Mr. Romyn Hitchcock.

APPALACHIAN MOUNTAIN CLUB, Boston, Jan. 10.—Mr. Wm. C. Bates read a paper on Jamaica mountain scenery.

BOSTON SOCIETY OF NATURAL HISTORY, Jan. 17.—Dr. S. Kneeland spoke of the native races of the Philippines and Indian ocean.

Feb. 7.—Dr. M. E. Wadsworth gave some instances of atmospheric action on sandstone. Mr. Lucien Carr discussed the social and political position of woman among the Huron-Iroquois tribes; and Mr. John A. Jeffries spoke of the dermal appendages of birds.